

Lower Passaic River Restoration Project



QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation

December 2007

PREPARED BY:

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FOR:

**US Environmental Protection Agency
Region 2**

**US Army Corps of Engineers
Kansas City District**

**Contract No.
W912DQ-06-D-0006, T.O. 0002**

**MALCOLM
PIRNIÉ**



Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Project - Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

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Contract: W912DQ-06-D-0006, T.O. 0002

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ACRONYMS

ANSETS	Analytical Services Tracking System
ASTM	American Society for Testing and Materials
Be-7	Beryllium 7
CARP	Contaminant Assessment Reduction Program
CAS	Chemical Abstracts Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CRM	Certified Reference Material
CRQL	Contract Required Quantitation Limit
Cs-137	Cesium 137
COC	Chain of Custody
CSO	Combined Sewer Overflow
CVAA	Cold Vapor Atomic Absorption
CVAFS	Cold Vapor Atomic Fluorescence Spectrometry
DDD	Dichlordiphenyldichloroethane
DDE	Dichlordiphenyldichloroethylene
DDT	Dichlordiphenyltrichloroethane
DDx	Sum of DDD, DDE, and DDT isomers
DESA	Division of Environmental Science and Assessment
DL	Detection Limit
DO	Dissolved Oxygen
DOT	Department of Transportation
DPM	Deputy Project Manager
DQI	Data Quality Indicators
DQA	Data Quality Audit
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EMBM	Empirical Mass Balance Model
EML	Environmental Measurement Laboratory
EQA	Environmental Quality Associates, Inc.
FSP	Field Sample Plan
GC-ECD	Gas Chromatography-Electron Capture Detector
GC/MS	Gas Chromatography-Mass Spectrometry
GPS	Global Positioning System
HASL	Health and Safety Laboratory
HRGC/HRMS	High Resolution Gas Chromatography-High Resolution Mass Spectrometry
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectrometry
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry

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K-40	Potassium 40
LIMS	Laboratory Information Management System
MB	Method Blank
MDL	Method Detection Limit
Mg/kg	milligram/kilogram
MS	Mass Spectrometer <i>or</i> Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not available
Ng/g	nanogram/gram
Ng/kg	nanogram/kilogram
NELAC	National Environmental Accreditation Conference
NJDEP	New Jersey Department of Environmental Protection
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Energy Research
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
pCi/g	picoCuries per gram of sediment
PCDD	Polychlorinated Dibenzodioxins
PCDD/F	Polychlorinated Dibenzodioxins/Furans
PCDF	Polychlorinated Dibenzofurans
Pg/g	picogram/gram
POC	Particulate Organic Carbon
PE	Performance Evaluation
PM	Project Manager
PSO	Project Safety Officer
PQL	Project Quantitation Limit
PQO	Project Quality Objectives
PRG	Preliminary Remediation Goals
PT	Performance Test
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
REDOX	Reduction/Oxidation
RI	Remedial Investigation
RM	River Mile
RPD	Relative Percent Difference
RSCC	Regional Sample Control Center

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SDG	Sample Delivery Group
SMO	Sample Management Officer
SOP	Standard Operating Procedure
SOW	Statement of Work
SPMD	Semi Permeable Membrane Devices
SQO	Site Quality Officer
SWO	Stormwater Outfall
TAL	Target Analyte List
TBD	To be determined
TOC	Total Organic Carbon
TOPS	Trace Organics Platform Sampler
TSA	Technical System Audit
TSI	Tierra Solutions, Inc.
TSS	Total Suspended Solids
UFP	Unified Federal Policy
ug/kg	microgram/kilogram
USACE-KC	United States Army Corps of Engineers-Kansas City District
USEPA	United States Environmental Protection Agency

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INTRODUCTION

This Quality Assurance Project Plan and Field Sampling Plan (QAPP/FSP) Addendum is an addendum to the August 2005 Lower Passaic River Restoration Project (herein referred to as the Study) QAPP and January 2006 FSP Volume 1. This QAPP/FSP Addendum details the planning and sampling processes for collecting surficial sediment samples, large volume water column suspended solids samples, suspended solids transported in CSO/SWO system and sediment cores to refine the Empirical Mass Balance Model (EMBM) (presented in Appendix D of the Draft Source Control Early Action Focused Feasibility Study, June 2007). It describes the implementation of the sampling, Quality Assurance (QA), and Quality Control (QC) activities developed for this program. The purpose of this addendum is to generate project data that will be used to gain a better understanding of the chemical signatures of the contaminants sources to the Lower Passaic River and to further refine estimates of the relative contribution of solids and contaminants from these sources. This document consists of applicable Uniform Federal Policy (UFP) QAPP worksheets, necessary Standard Operating Procedures (SOPs) for the field activities, and applicable FSP sections in Appendix A.

Background information

The sediments of the Lower Passaic River have been and continue to be contaminated by external and internal sources. Data collected to date describe the current levels of contamination present in the sediments, but further data are desired to better refine the estimates of loads to the river. The sampling program described in this QAPP/FSP Addendum aims to provide additional data that will characterize the external and internal sources of contaminants. Sources of contamination are to be evaluated inferentially through analysis and assessment of solids transported in the water column of the Lower Passaic River and its tributaries, recently-deposited surficial sediments, and solids from Combined Sewer Overflow (CSO) and Stormwater Outfall (SWO) systems. In addition, further information is required to characterize sediment deposits above river mile 8 (RM8) so that their potential future impact can be estimated with regard to possible remedial scenarios for the lower 8 miles of the river.

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The field sampling activities for this project include the following work elements:

Water Column Sampling on Tributaries and Upper Passaic River

- Sampling locations: There will be four sampling locations for the water column suspended solids sampling on tributaries, and they are located above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or at the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Locations will generally correspond to the 2005 sampling locations for the Semi-Permeable Membrane Device (SPMD) deployments (Figure 1 of Appendix A - FSP Addendum).
- Up to four sampling events plus two, or more, unscheduled events to capture a heavy rainfall. A total of 6 sampling events (plus QA/QC samples) are possible. "Heavy rainfall event" samples will be collected after the actual heavy rainfall. These samples are not designed to capture the variations in the nature of the particles as a function of rising limb and falling limb. The variations in the nature of the particles will be captured by sampling more than one heavy rainfall events.
- At each location, a suspended matter sample using the large volume water column techniques similar to those tested by Malcolm Pirnie, Inc. in 2005 will be collected. A multi-parameter sonde, or similar monitoring device, will be used to measure pH, temperature, dissolved oxygen (DO), redox (reduction/oxidation) potential and conductivity. Turbidity and flow will also be monitored during each sampling event.
- Samples will be analyzed for particulate organic carbon (POC), total suspended solids (TSS), polychlorinated biphenyl (PCB) congeners, polychlorinated dibenzodioxins/furans (PCDD/F), polycyclic aromatic hydrocarbons (PAH), pesticides, and Target Analyte List (TAL) metals plus titanium and mercury.

Sediment Sampling on Tributaries, Upper Passaic River, and Lower Passaic River**Recently-Deposited Surface Sediment Sampling on Tributaries and Upper Passaic River:**

- Sampling locations: There will be four sampling locations for the sediment sampling on tributaries, and they are located above the head of tide on Saddle River, above the head of tide

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on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or upriver of the Ackerman Avenue Bridge (RM 17) on the Lower Passaic River]. Locations will be within the vicinity of the 2005 sampling locations for the semi permeable membrane device (SPMD) deployments (Figure 1 of Appendix A - FSP Addendum).

- At each location, surface sediment samples will be collected using either a short-coring device, piston core, or an Ekman dredge. Samples will represent a sediment depth of 0-1 inch and have sufficient mass to analyze for the suite of parameters listed below.
- Each sample will be analyzed for beryllium-7 (Be-7), cesium-137 (Cs-137), potassium-40 (K-40), total organic carbon (TOC), grain size, and TAL metals plus titanium and mercury. Selected samples that have detectable quantities of Be-7, representing a modern depositional environment, will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides.

Recently-Deposited Surface Sediment Sampling on the Lower Passaic River:

- There will be 20 sampling locations correspond to the 2005 Be-7 field reconnaissance locations with detectable levels of Be-7. Figures 2-1 through 2-12 of Appendix A - FSP Addendum shows target areas and existing Be-7 sample locations which serve as a guide to locate the 20 recently-deposited surface sediment locations. The 20 sampling locations will be finalized based on probing and existing information of Be-7 sample locations shown in Figures 2-1 through 2-12.
- At each location, a surface sediment sample using either a short-coring device, piston core, or an Ekman dredge will be collected. Samples will represent a sediment depth of 0-1 inch and have sufficient mass to analyze for the suite of parameters listed below.
- Each sample will be analyzed for Be-7, Cs-137, K-40, TOC, grain size, and TAL metals plus titanium and mercury. Eight samples that have detectable quantities of Be-7, representing a modern depositional environment, will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides.

Supplemental Sediment Coring Above RM8

- There will be 20 sampling locations above RM8, three of which correspond to previous Sedflume core locations with the remainder of the samples to be collected within fine-grained sediment deposits, determined from previous coring logs and the field reconnaissance probing

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that will be performed at the beginning of the field activities (Figure 3-1 and 3-2 of Appendix A – FSP Addendum).

- At each location, an attempt will be made to collect a sediment core using a piston-coring device. Samples should be sub-sampled into two intervals, defined as 0-6 inches (below river bottom) and 6 inches to refusal or the background dark-reddish brown clay is encountered. Samples should have a sufficient mass to analyze the suite of parameters listed below.
- Each sample will be analyzed for Cs-137, K-40, TOC, grain size, PCB Aroclors, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury
- Samples will be used to characterize the contaminant inventories of the fine-grained sediment lenses above RM8; the top six inch interval is considered the most likely to erode during a high-flow event.

Combined Sewer Overflow (CSO)/ Stormwater Outfall (SWO) Sampling

CSO “Regulator” Overflow Large Volume Water Column Sampling:

- There are 8 sampling locations for the CSO sampling (Figures 4-1 and 4-2 of Appendix A – FSP Addendum). These 8 locations were chosen for the following:
 - The CSOs drain to the Passaic River
 - The total area contained in the ‘sewershed’ (*i.e.*, the size of the sewage drainage area) is significant
 - Field reconnaissance conducted with PVSC personnel
 - Safe access to the CSO manhole (*i.e.*, not in the middle of the road)
 - Access to the outfall side of the discharge from the regulator.
 - Engineering drawings provided by PVSC
- There will be 4 rainfall sampling events, if possible.
- There will be 4 locations sampled per event, if possible.
- At each location, collect large volume water samples using a peristaltic pump. Total number of samples for the CSO sampling will be a maximum of 16 samples, if possible, collected during 4 events at 4 locations plus QA/QC samples.
- Each sample will be analyzed for POC, grain size, PCB congener, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The laboratories will perform the filtration of the water sample. Water samples will also be tested for TSS.

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- A multi-parameter sonde, or similar monitoring device, will be used to measure pH, temperature, DO, redox potential and salinity (salinity will be used to determine if river water has been purged from the system during discharge.)

SWO Sampling:

- There will be 8 to 10 sampling locations, if possible, selected from the observed SWO river outfalls. Figure 4-3 of Appendix A – FSP addendum shows the location of the SWO outfalls that discharge to the Passaic River identified during the first field reconnaissance. Further field reconnaissance will be performed to finalize the selection of the SWO sampling locations. The selection of the SWOs will be based on the following:
 - The SWOs drain to the Passaic River
 - Total acreage of the drainage area is significant
 - Safe access to the SWO manhole (*i.e.*, not in the middle of the road)
 - Engineering drawings provided by PVSC
 - Communication with Township/City engineering department officials
 - Permission to sample at the locations
- There will be 4 rainfall sampling events, if possible
- There will be 4 locations sampled per event.
- At each location, collect large volume water samples using a peristaltic pump. Total number of samples for the SWO sampling will be maximum of 16 samples collected if possible during 4 events at 4 locations plus QA/QC samples.
- Each sample will be analyzed for POC, grain size, PCBs, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The laboratories will perform the filtration of the water sample. Water samples will also be tested for TSS
- A multi-parameter sonde, or similar monitoring device, will be used to measure pH, temperature, DO, redox potential and salinity (salinity will be used to determine if river water has been purged from the system during discharge).

Additional background information on the Study can also be found on the USEPA public website:

www.ourPassaic.org

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QAPP Worksheet #1 (UFP-QAPP Manual Section 2.1) -- Title and Approval Page

QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation

Document Title

USEPA Region 2

Lead Organization

James McCann and Juliana Atmadja, Malcolm Pirnie, Inc.

Preparer's Name and Organizational Affiliation

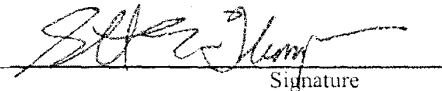
17-17 Route 208 North, Fair Lawn, NJ 07410, 201-398-4310 and 201-398-4314, jmcannon@pirnie.com and latmadja@pirnie.com

Preparer's Address, Telephone Number, and E-mail Address

November 28, 2007

Preparation Date (Day/Month/Year)

Investigative Organization's Project Leader:



Signature

Scott Thompson, Malcolm Pirnie, Inc.
Printed Name/Organization/Date

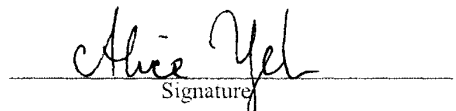
Investigative Organization's Quality Assurance Officer:

 12/13/07

Signature

James McCann, Malcolm Pirnie, Inc.
Printed Name/Organization/Date

Lead Organization's Project Manager:



Signature

Alice Yeh, USEPA Region 2
Printed Name/Organization/Date

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QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) -- QAPP Identifying Information

Site Number/Code: NJD980528996

Operable Units: OU-2

Contractor Name: Malcolm Pirnie, Inc.

Contract Number: W912DQ-06-D-0006, T.O. 0002 (USACE, Kansas City District)

Contract Title: Indefinite Delivery/Indefinite Quantity Type Contract for Miscellaneous Military and Civil Hazardous Waste Cleanup Projects and Related Work

Work Assignment Number: Task Order to be determined. Preparation of QAPP/FSP Addendum was done under Task Order 0002

1. Identify guidance used to prepare QAPP:
Uniform Federal Policy for Quality Assurance Project Plans, Final Version March 2005

2. Identify regulatory program:
Comprehensive Environmental Response, Compensation & Liability Act (CERCLA)

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a generic or a **[project-specific]** QAPP.

5. List dates of scoping sessions that were held:

Scoping sessions were held from October 2007 through November 2007.
General scoping sessions:

6. List dates and titles of QAPP and FSP documents written for previous site work, if applicable:

Title	Received Date
Lower Passaic River Restoration Project QAPP	August 2005
Lower Passaic River Restoration Project FSP Volume 1	January 2006

7. List organizational partners (stakeholders) and connection with lead organization:
U.S. Army Corps of Engineers-Kansas City District (USACE-KC) performs contract management for USEPA Region 2, Malcolm Pirnie, Inc. provides consulting services under contract to USACE-KC, and Battelle and HydroQual, Inc. are Malcolm Pirnie, Inc.'s team subconsultants.

8. List data users:
USEPA Region 2, USACE-KC, and Malcolm Pirnie, Inc.

9. If any required QAPP elements and required information are not applicable to the project, then note the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:

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QAPP Worksheet #2
QAPP Identifying Information
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Required QAPP Element(s) and Corresponding QAPP Section(s)	<i>Required Information</i>	Crosswalk to Worksheet # or Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	Page 3 and Worksheet 2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5, Figure 1 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	9 9 10 See Introduction for background. Maps Figures 1, 2-1 through 2-12 and 3-1 and 3-2 of the FSP in Appendix A
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 –See Attachments 1.1 and 1.2 for Data Quality Objectives (DQOs) 12

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QAPP Worksheet #2
QAPP Identifying Information
(Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	<i>Required Information</i>	<i>Crosswalk to Worksheet # or Related Documents</i>
2.7 Secondary Data Evaluation	<ul style="list-style-type: none"> - Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table 	13
2.8 Project Overview and Schedule	<ul style="list-style-type: none"> - Summary of Project Tasks 	14
2.8.1 Project Overview	<ul style="list-style-type: none"> - Reference Limits and Evaluation Table 	15
2.8.2 Project Schedule	<ul style="list-style-type: none"> - Project Schedule/Timeline Table 	16
<i>Measurement/Data Acquisition</i>		
3.1 Sampling Tasks	<ul style="list-style-type: none"> - Sampling Design and Rationale 	17
3.1.1 Sampling Process Design and Rationale	<ul style="list-style-type: none"> - Sample Location Map 	18
3.1.2 Sampling Procedures & Requirements	<ul style="list-style-type: none"> - Sampling Locations and Methods/SOP Requirements 	19
3.1.2.1 Sampling Collection Procedures	<ul style="list-style-type: none"> - Analytical Methods/SOP Requirements Table 	20
3.1.2.2 Sample Containers, Volume, and Preservation	<ul style="list-style-type: none"> - Field Quality Control Sample Summary Table 	21
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	<ul style="list-style-type: none"> - Sampling SOPs 	22
3.1.2.3 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	<ul style="list-style-type: none"> - Project Sampling SOP References Table 	23
3.1.2.4 Supply Inspection and Acceptance Procedures	<ul style="list-style-type: none"> - Field Equipment Calibration, Maintenance, Testing, and Inspection Table 	24
3.1.2.6 Field Documentation Procedures		25
3.2 Analytical Tasks	<ul style="list-style-type: none"> - Analytical SOPs 	26
3.2.1 Analytical SOPs	<ul style="list-style-type: none"> - Analytical SOP References Table 	27
3.2.2 Analytical Instrument Calibration Procedures	<ul style="list-style-type: none"> - Analytical Instrument Calibration Table 	28
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	<ul style="list-style-type: none"> - Analytical Instrument and Equipment Maintenance, Testing, & Inspection Table 	29
3.2.4 Analytical Supply Inspection and Acceptance Procedures		

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QAPP Worksheet #2
QAPP Identifying Information
(Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Worksheet of Related Documents
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	<ul style="list-style-type: none"> - Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal 	26, 27 See SOP 1 in Attachment 3 See Attachment 4
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	<ul style="list-style-type: none"> - QC Samples Table - Screening/Confirmatory Analysis Decision Tree 	28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	<ul style="list-style-type: none"> - Project Documents and Records Table - Analytical Services Table - Data Management SOPs 	29 30
Assessment		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	<ul style="list-style-type: none"> - Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table 	31 32
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report		

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QAPP Worksheet #2
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(Continued)

<i>Data Review</i>		
5.1 Overview		
Data Review Steps		
Step I: Verification	- Verification (Sept I) Process Table	34
5.2.2 Step II: Validation		
5.2.2.1 Step IIa Validation Activities	- Validation (Steps IIa and IIb) Process Table	35
5.2.2.2 Step IIb Validation Activities		
5.2.3 Step II: Usability Assessment	- Validation (Steps IIa and IIb) Process Table	36
5.2.3.1 Data Limitations and Actions for Usability Assessment		
5.2.3.2 Activities	- Usability Assessment	37
Streamlining Data Review		
Data Review Steps To Be Streamlined		Not applicable
Criteria for Streamlining Data Review		
Amounts and Types of Data Appropriate for Streamlining		

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QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) -- Distribution List

List those entities to who receive copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments.

The following persons will receive a copy of the approved Final QAPP, subsequent QAPP revisions, addenda, and amendments:

Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Alice Yeh	USEPA Project Manager	USEPA Region 2	212-637-4427	212-637-4393	yeh.alice@epa.gov	P0001
Beth Buckrucker	USACE-KC-Project Manager	USACE - KC	816-389-3581	816-389-2023	elizabeth.a.buckrucker@usace.army.mil	P0002
William Sy	USEPA-Project Chemist	USEPA Region 2	732-632-4766	732-321-6622	Sy.william@epa.gov	P0003
Other project team members and stakeholders as directed by USEPA						

Electronic copies of the QAPP/FSP Addendum will be posted on the project database and www.ourPassaic.org. Using the project database, the project team can access the latest version of this document.



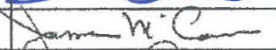
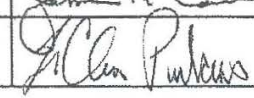
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QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) -- Project Personnel Sign-Off Sheet

Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable QAPP sections and will perform the tasks as described. Ask each organization to forward signed sheets to the central project file.

Organization: Malcolm Pirnie, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
Scott Thompson	Project Manager (PM)	914-641-2628		12/19/07
Shane McDonald	Technical Deputy Project Manager (DPM)	484-688-0364		12/21/07
James McCann	Site Quality Officer (SQO)	201-398-4310		12/17/07
Chris Purkiss	Field Investigation Manager	201-398-4384		12/20/07

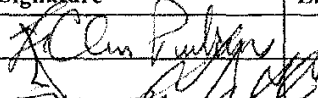
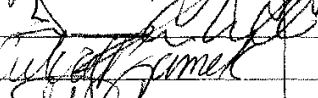
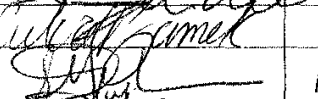
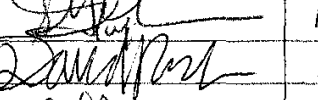
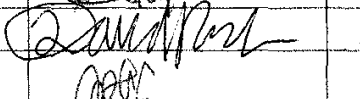
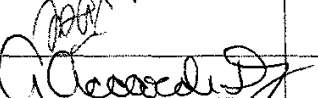
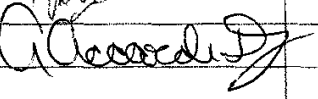
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QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) -- Project Personnel Sign-Off Sheet

Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable QAPP sections and will perform the tasks as described. Ask each organization to forward signed sheets to the central project file.

Organization: Malcolm Pirnie, Inc

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
Chris Purkiss	Field Team Leader	201-398-4384		12/20/07
Doug Auld	Field Team Leader	201-398-4351		12/19/07
Erika Zamek	Field Team Leader	914-641-2961		12/20/07
Solomon Gbondo-Tugbawa	Field Team Leader	201-398-4407		12/19/07
Dave Foster	Boat Captain	914-641-2777		12/21/07
Juliana Atmadja	Sample Management Officer (SMO)	201-398-4314		12/17/07
AmyMarie Accardi-Dey	SMO	914-641-2699		12/19/07
To be determined	Other Field Team Members			

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QAPP Worksheet #5 (UFP-QAPP Manual Section 2.4.1) -- Project Organizational Chart**Project Organizational Chart**

The Organizational Chart is provided as Figure 1 and a description of the project organization and the roles of the team members are provided below:

Project Management Structure

Scott Thompson, PE, Project Manager (PM), is primarily responsible for the development and implementation of the field investigation. As part of this responsibility, he will:

- Lead the activities of the project team and the subcontractors.
- Maintain ensure timely submission of deliverables.
- Communicate directly with USACE-KC, USEPA and stakeholders.
- Approve reports and material for release to USACE-KC and other external agencies.
- Oversee subcontractor performance.
- Allocate resources and staffing to implement the project work.

Shane McDonald, Technical Deputy Project Manager (DPM), reports directly to, and works with, the Malcolm Pirnie, Inc. PM. As delegated, the Technical DPM is responsible for interacting with the USEPA and USACE-KC, project team members, subcontractors, and stakeholders to ensure that the project is completed according to plan and in a timely manner. The Technical DPM is accountable directly to the PM and is responsible for the logistics of project activities such as:

- Preparing reports/products.

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- Coordinating office and field activities.
- Timely submission of deliverables.
- Scheduling activities.
- Providing technical support to USEPA and USACE-KC.
- Providing technical direction and support to field staff conducting activities.

Bruce Fidler, PE, and Edward Garvey, QA/QC Officers, are responsible for providing technical direction and overall strategy, facilitating consistency with other sediment investigations in the region, such as the Newark Bay Study Area and Berry's Creek, and quality assurance of deliverables. The QA/QC Officers will:

- Provide advice and input on the scope and sequencing of work.
- Provide technical input for the preparation of deliverables such as work plans, reports, and technical memoranda, as well as other tasks performed under this contract.
- Coordinate with members of the Quality Control Team.
- Participate in QC reviews of submittals and prepare QC checklists.
- Coordinate team attendance at independent peer reviews of project scientific deliverables, and preparation of responses.
- Arrange technical advisory committee reviews and activities.

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Chris Purkiss, Field Investigation Manager, is responsible for implementation of tasks performed as part of a given field event. If warranted, multiple field team leaders may be identified if multiple activities are scheduled concurrently. The Field Investigation Manager is responsible for:

- Coordinating the work of Malcolm Pirnie, Inc. and subcontractor field team members.
- Mobilizing the necessary equipment and personnel to conduct the work.
- Making sure that the planning documents are properly followed, including the SOPs.

Jim McCann, SQO is responsible for on-going supervision of project activities to ensure conformance to the planning documents and to evaluate the effectiveness of their requirements. The SQO will have access to any personnel (internal or subcontractors), as necessary, to resolve technical problems, and has the authority to recommend that work be stopped when that work appears to jeopardize the quality of the project efforts. The SQO will conduct regularly scheduled Technical System Audits (TSAs) of each type of field activity and will also be available to respond to any QA/QC problem. The SQO will be responsible for making sure that corrective actions called for as a result of a TSA are addressed. In addition, the SQO will be responsible for:

- Monitoring the correction of quality problems and alerting task managers where similar problems might occur.
- Developing and maintaining project QA files for the retention of sampling, monitoring, and field QA records.
- Participating in QA audits and conducting TSAs.
- Recommending changes to the PM to improve the effectiveness of the project in attaining its QA objectives for field, sampling, and monitoring activities.
- Making sure that the planning documents are being followed.
- Reviewing proposed additions and changes to this QAPP.

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- Reviewing deliverables for technical content and quality objectives.
- Overseeing the QA of the Contract Laboratory Program (CLP) via the Regional Sample Control Center (RSCC) and subcontract laboratories, as well as data validators.

To Be Determined, Project Safety Officer (PSO) will have access to any personnel or subcontractors, as necessary, to resolve health and safety problems, and will have the authority to stop work when that work appears to jeopardize safety. The PSO is responsible for identifying and prescribing appropriate protective measures. The PSO is responsible for:

- Performing periodic health and safety audits.
- Checking that health and safety procedures are observed in the field.
- Monitoring personnel exposure to chemical toxins.
- Developing emergency response procedures.
- Monitoring for physical stress (*e.g.*, temperature).
- Establishing personnel and equipment decontamination procedures.
- Assigning alternate PSOs or designees in cases where more than one field team is operating at a time.

Field Team Leaders. The Field Team Leaders report to the Field Investigation Manager. More than one Field Team may be assigned to perform the work. Each field team is responsible for:

- Performing their assigned field sampling activities (as directed by their respective Field Team Leader and Field Investigation Manager).
- Make sure that the planning documents are properly followed, including the SOPs.

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AmyMarie Accardi-Dey and Juliana Atmadja, SMOs are tasked with the care and custody of environmental samples collected for the project. The SMOs are responsible for:

- Maintaining custody of the samples and preparing proper documentation of their transport to the laboratories.
- Checking that the sample bottles are correctly labeled and the chain-of-custody (COC) forms and sample tags are properly filled out.
- Maintaining project SMO files including COCs and bills of lading.
- Making sure that the samples are properly preserved and custody sealed.
- Checking that the samples are properly bagged and packed to minimize the potential for cross-contamination.
- Coordinating sample delivery and receipt with the laboratory(ies).
- Coordinating with the CLP and subcontractor laboratories to arrange for shipment of the samples.

Subcontractor Team Members

It is anticipated that subcontractor laboratories such as Axys Analytical Services, Inc (Axys Analytical, Brooks Rand, OutReach Analytical, and Test America (formerly Severn Trent Laboratories South Burlington, Vermont), previously contracted to perform environmental sample analyses for the study, and others such as Accutest, GeoSea and possibly Battelle will be utilized to perform analyses. Dr. Richard Bopp's laboratory at Rensselaer Polytechnic Institute may also be called upon to perform confirmatory radiochemistry analyses. It is also anticipated that the subcontractors previously used to validate data such as Environmental Quality Associates, Inc. (EQA) and H&S Environmental, Inc., will also participate in the validation of the sample data along with experienced Malcolm Pirnie, Inc. data validators.

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QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) -- Communication Pathways

Describe the communication pathways and modes of communication that will be used during the project, after the QAPP has been approved. Describe the procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff. Describe the procedure that will be followed when any project activity originally documented in an approved QAPP requires real-time modification to achieve project goals or a QAPP amendment is required. Describe the procedures for stopping work and identify who is responsible.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, pathways, etc.)
Approval of Amendments to the QAPP	Malcolm Pirnie	SQO with PM and Technical DPM	201-398-4310	Obtain initial approval from Malcolm Pirnie's PM and Technical DPM. Submit documented amendments within 10 working days for transmittal to USACE-KC and USEPA for approval.
Document Control	Malcolm Pirnie	PM or Technical DPM designee	914-641-2628	Project document preparation and distribution to USACE-KC and USEPA for review and approval.
Stop Work and Initiation of Corrective action	Malcolm Pirnie	PM or Technical DPM	914-641-2628 484-688-0364	The PM or Technical DPM communicates within 24 hours of stop work to the project organization by phone with confirming e-mail.
Real time modification, notifications and approval	Malcolm Pirnie	SQO with PM/Technical DPM approval	201-398-4310	Real time modification to the project will require the approval of the SQO and PM or Technical DPM or designees and will be documented using the Field Modifications Form in Attachment 10 within five working days.
Reporting of serious issues	Malcolm Pirnie	PM or Technical DPM	914-641-2628 484-688-0364	Field Team Member will report serious issues to the PM or his designee. The PM will report any serious issues to the USEPA and USACE-KC and other concerned parties by e-mail or memo.
Meeting Minutes	Malcolm Pirnie	PM and Technical DPM	914-641-2628 484-688-0364	Post approved meeting minutes, or distribute by e-mail within a week.
Corrective action, audit finding	Malcolm Pirnie	SQO (or designee)	201-398-4310	Problems or negative audit finding are reported to the PM or Technical DPM by e-mail within a week.

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QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) -- Personnel Responsibilities and Qualifications Table

Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. Include data users, decision-makers, project managers, QA officers, project contacts for organizations involved in the project, project health and safety officers, geotechnical engineers and hydrogeologists, field operation personnel, analytical services, and data reviewers. Attach resumes to this worksheet or note the location of the resumes.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Alice Yeh	Project Manager	USEPA Region 2	Project Manager	NA
Beth Buckrucker	Project Manager	USACE-KC	USACE-KC PM	NA
Scott Thompson	Senior Associate	Malcolm Pirnie, Inc.	PM	Environmental Engineer MS/BS Engineering, P.E.
Bruce Fidler	Senior Associate	Malcolm Pirnie, Inc.	QA/QC	MS/BS Engineering, P.E., BCEE Experienced (27+ years) Environmental Engineer and Project Manager. Expert on sediment studies.
Ed Garvey	Senior Associate	Malcolm Pirnie, Inc.	QA/QC	PhD in geochemistry. Recognized for expertise in Geochemistry and Geological Sciences.
James McCann	Senior Project Chemist	Malcolm Pirnie, Inc.	SQO	MA/BS in Chemistry, 40+ years of experience in analytical chemistry, environmental testing, and quality assurance.
Shane McDonald	Associate	Malcolm Pirnie, Inc.	Technical DPM	Expert in the application of computers to geologic and hydrogeologic data and in the use of computer models and

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Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
				GIS.
Chris Purkiss	Senior Project Engineer	Malcolm Pirnie, Inc.	Field Investigation Manager and Field Team Leader	BA-Biology MS Environmental Engineering 34 yrs experience specializing in project management, site operations coordination, hazardous waste remedial investigations, wastewater treatability studies, and laboratory analysis.
Juliana Atmadja	Project Engineer	Malcolm Pirnie, Inc.	SMO	ScD in Civil Engineering, P.E.; experienced in sample management; fate and transport modeling in groundwater and surface water; geochemical data analysis; statistical and geostatistical analyses of environmental data.
AmyMarie Accardi-Dey	Project Environmental Scientist	Malcolm Pirnie, Inc.	SMO	PhD –Geochemist and chemical oceanographer experienced in geochemistry, environmental chemistry, and the study of contaminant fate and transport.
S. Gbondo-Tugbawa	Project Engineer	Malcolm Pirnie, Inc.	Field Team Leader	PhD, P.E. -Specializes in geochemistry, modeling, and

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Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
				statistical techniques.
Erika Zamek	Project Environmental Scientist	Malcolm Pirnie, Inc.	Field Team Leader	BS-Environmental Biology, MS- Environmental Geochemistry.
Douglas Auld	Project Geologist	Malcolm Pirnie, Inc.	Field Team Leader	Hydrogeologist, P.G., 15 years of experience in the field of multi-disciplinary geological and hydrogeological consulting services to federal, state, municipal, industrial and private clients throughout the eastern United States.
Dave Foster	Project Engineer	Malcolm Pirnie, Inc.	Boat Captain	BS- Mechanical Engineering, MS-Hazardous Waste Management, experienced in design and construction oversight in compliance with environmental requirements for municipal, federal, and industrial clients in New York and New Jersey.

*Malcolm Pirnie Inc Project team member resumes posted on the project database and www.passaic.org.

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QAPP Worksheet #8 (UFP-QAPP Manual Section 2.4.4) -- Special Personnel Training Requirements Table

Study Function	<i>Specialized Training – Title or Description of Course</i>	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Sampler and on-site personnel	Safety and Occupational Safety and Health Administration (OSHA) training as specified in the Health and Safety Plan	Malcolm Pirnie, Inc	Training dates kept in company/project training records	All field team members working on site	All Malcolm Pirnie, Inc and subcontractor personnel working on site	Malcolm Pirnie, Inc Study Files

Note: Training Records will be kept in the Malcolm Pirnie, Inc. files.

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QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) -- Project Scoping Session Participants Sheet

Complete this worksheet for each project scoping session held. Identify project team members who are responsible for planning the project.

Project Scoping Process Participants Sheet

Project Name: Lower Passaic River Restoration Project				Site Name: Lower Passaic River	
Projected Date(s) of Sampling:				Site Location: Newark, New Jersey	
Project Manager: Alice Yeh					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Alice Yeh	Project Manager	USEPA, Region 2	212-637-4427	yeh.alice@epa.gov	USEPA Project Manager
Beth Buckrucker	Project Manager	USACE-KC Kansas City	816-389-3581	elizabeth.a.buckrucker@usace.army.mil	USACE-KC Project Manager
Earl Hayter	Research Environmental Engineer	USEPA National Exposure Research Laboratory	706-355-8303	hayter.earl@epa.gov	
Eugenia Naranjo	Environmental Scientist	USEPA	212-637-3467	Naranjo.Eugenia@epa.gov	
Robin Miller	Associate	Hydroqual, Inc.	201-529-5151 ext. 7119	rmiller@hydroqual.com	Modeling Consultant
Ed Garland	Senior Associate	Hydroqual, Inc.	201-529-5151 ext. 7126	egarland@hydroqual.com	Modeling Consultant
Dr. Richard Bopp	Associate Professor	Rensselaer Polytechnic Institute	518-276-3075	boppr@rpi.edu	Technical Consultant
Dr. Edward Garvey	Senior Associate	Malcolm Pirnie, Inc.	201-398-4326	egarvey@pirnie.com	QA/QC Officer
Scott Thompson	Senior Associate	Malcolm Pirnie, Inc.	914-641-2628	sthompson@pirnier.com	Investigative Project Manager
Bruce Fidler	Senior Associate	Malcolm Pirnie, Inc.	201-398-4365	bfidler@pirnie.com	QA/QC Officer
Len Warner	Associate	Malcolm Pirnie, Inc.	914-641-2972	lwarner@pirnie.com	Investigative Project Manager (Newark Bay)
Dr. Solomon Gbondo-Tugbawa	Project Engineer	Malcolm Pirnie, Inc.	201-398-4407	Stugbawa@pirnie.com	Geochemistry and Fate and Transport Analysis

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Project Scoping Process Participants Sheet

Project Name: Lower Passaic River Restoration Project Projected Date(s) of Sampling: Project Manager: Alice Yeh				Site Name: Lower Passaic River Site Location: Newark, New Jersey	
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Dr. Juliana Atmadja	Project Engineer	Malcolm Pirnie, Inc.	201-398-4314	jatmadja@pirnie.com	Document Development
James McCann	Senior Project Scientist	Malcolm Pirnie, Inc.	201-398-4310	jmccann@pirnie.com	SQO, Chemist
Chris Purkiss	Senior Project Engineer	Malcolm Pirnie, Inc.	201-398-4384	cpurkiss@pirnie.com	Field Investigation Manager
Dustin Grzesik	Project Geologist	Malcolm Pirnie, Inc.	201-398-4325	dgrzesik@pirnie.com	Planning staff

Comments/Decisions: The above parties discussed the development of the proposed field sampling plans during the fall 2007 negotiation period.

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QAPP Worksheet #10 (UFP-QAPP Manual Section 2.5.2) -- Problem Definition**Problem Definition:**

The proposed sampling consists of the collection of surficial sediment, water column suspended solids, solids transported into the Lower Passaic River by CSOs/SWOs, and sediment cores to support refinement of the EMBM for the Study. The sediments of the Lower Passaic River have been and continue to be contaminated by external and internal sources to the river. Data collected to date describe the current levels of contamination reaching the river, but further data are desired to better refine the estimates of external and internal loads to the river.

The sampling program described in this QAPP/FSP Amendment aims to provide additional data that will characterize the external and internal sources of contaminants. External sources of contamination are to be evaluated inferentially through analysis and assessment of solids transported in the water column of the Lower Passaic River, its tributaries and solids from the CSO/SWO system. In addition, further information is required to characterize sediment deposits above RM8 and recently-deposited surficial sediments throughout the river, so that their potential future impact can be estimated with regard to possible remedial scenarios for the lower 8 miles of the river.

The field data collected during this program will be used to further characterize:

- The chemical characteristics of recent (2005-2007) and very recent (fall 2007) suspended matter transported in the water column of the tributaries to the Lower Passaic River and the Upper Passaic River.
- The chemical characteristics of recently-deposited surface sediments in the Lower Passaic River.
- The physical (grain size, sediment texture) and chemical characteristics of fine-grained sediment deposits above RM8.
- To characterize chemical contamination present in the recent suspended matter at CSO/SWO sites.

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QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) -- Study Quality Objectives/Systematic Planning Process Statements

Study Quality Objectives:

The Study quality objectives and data needs are fully described in the DQOs in Attachments 1.1 and 1.2.

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QAPP Worksheet #12

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	Sediment and filters (0.5 micron glass cartridge filter plus possible 0.7 micron glass flat filters)				
Analytical Group	PCB Congeners				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	USEPA Method 1668A (For Axy's SOP Summary, which follows USEPA Method 1668A, see Attachment 6)	Precision	Relative Percent Difference (RPD) $\leq 40\%$ for duplicate values greater than or equal to 5 times the Quantitation Limit (QL)	Field Duplicates	S & A
		Accuracy/Bias	Per 1668A	Initial Calibration	A
		Accuracy/Bias	Per 1668A	Calibration Verification	A
		Accuracy/Bias	Per recoveries given in 1668A	Laboratory Control Sample	A
		Sensitivity	Per 1668A	Method Blanks (MB)	A
		Sensitivity	Per 1668A	Method Detection Limits (MDLs)	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The assigned laboratory must perform and meet all quality assurance requirements specified in USEPA Method 1668A, including: performance of initial and ongoing studies, calibration verification, addition of internal standards, analyses of blanks, and determination of detection limits.

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Measurement Performance Criteria Table

Matrix	Sediment and filters (0.5 micron glass cartridge filter plus possible 0.7 micron glass flat filters)				
Analytical Group	PCDD/Fs				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	USEPA Method 1613B (For Axy's SOP Summary, which follows USEPA Method 1613B, see Attachment 6)	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL	Field Duplicates	S & A
		Accuracy/Bias	Per 1613B	Initial Calibration	A
		Accuracy/Bias	Per 1613B	Calibration Verification	A
		Accuracy/Bias	Per recoveries given in 1613B	Laboratory Control Sample	A
		Sensitivity	Per 1613B	MB	A
		Sensitivity	Per 1613B	MDLs	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The assigned laboratory must perform and meet all quality assurance requirements specified in USEPA Method 1613B, including: performance of initial and ongoing studies, calibration verification, addition of internal standards, analyses of blanks and determination of detection limits.

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Measurement Performance Criteria Table

Matrix	Sediment and filters (0.5 micron glass cartridge filter plus possible 0.7 micron glass flat filters)				
Analytical Group	Chlorinated Pesticides				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	Axys Method MLA-028 based upon a method similar to USEPA Method 1613B (For Axys SOP Summary See Attachment 6)	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL	Field Duplicates	S & A
		Precision	RPD \leq 30% for duplicate values greater than or equal to 5 times the detection limits (DL)	Lab Duplicates	A
		Accuracy/Bias	Per Axys MLA-028	Initial Calibration	A
		Accuracy/Bias	Per Axys MLA-028	Calibration Verification	A
		Accuracy/Bias	Recovery 40-102% RPD $<$ 30%	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	A
		Accuracy/Bias	Per recoveries given in MLA-028	Laboratory Control Sample	A
		Sensitivity	Per Axys MLA-028	MB	A
		Sensitivity	Per Axys MLA-028	MDLs	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The assigned laboratory must perform and meet all quality assurance requirements specified in MLA-028 including: performance of initial and ongoing studies, calibration verification, addition of internal standards, analyses of blanks and determination of detection limits.

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Measurement Performance Criteria Table

Matrix	Sediment and filters (0.5 micron glass cartridge fiber and possible 0.7 micron glass flat filters)				
Analytical Group	PAH				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	Axys Method MLA-021 based upon GC/MS (modified SW-846 -8270)	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the CRQL	Field Duplicates	S & A
		Precision	RPD \leq 30% for duplicate values greater than or equal to 5 times the QL	Lab Duplicates	A
		Accuracy/Bias	Recovery 40-120%	Laboratory Control Standard	A
		Accuracy/Bias /Precision	Per recovery 40-120%, RPD $<$ 30%	MS/MSD or blank spike and duplicate blank spike	A
		Accuracy/Bias	Deuterated Monitoring Compound recoveries per SOP	Deuterated Monitoring Compounds	A
		Sensitivity	Per requirements in SOP	MDLs	A
		Sensitivity	Per lab SOP	MB	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The assigned laboratory must meet all the measurement performance criteria, which assess the analytical DQIs, as specified in the applicable laboratory SOP.

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Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group	TAL Metals, Titanium, Mercury				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	SW-846 methods 6020 and or 6010B plus 7470A ^{1, 2, 3}	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL	Field Duplicates	S & A
		Precision	RPD \leq 30% for mercury RPD \leq 20% for other metal	Laboratory Duplicates	A
		Accuracy Sensitivity	Recovery 80-120%	Blank spike	A
		Accuracy	Recovery 75-125% for ICP-AES ² 60-144% for Mercury for ICP-MS ³ per QC limits	MS	A
		Sensitivity	Less than QLs	MB	A
		Sensitivity	Low enough to support the lab QLs.	MDLs	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The assigned laboratory must meet all the measurement performance criteria, which assess the analytical DQIs, as specified in the applicable USEPA methods. The subcontract lab will perform the TAL Metals plus titanium and mercury analyses following SW-846 method criteria.
2. Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)
3. Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

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Measurement Performance Criteria Table

Matrix	Water column suspended sediment (collected on 0.47 micron flat filters)				
Analytical Group	Trace TAL Metals plus Titanium and mercury				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	USEPA Method 1631 for mercury and USEPA Method 1631 the other metals	Precision	RPD \leq 50% for duplicate values greater than or equal to 5 times the CRQL	Field Duplicates	S & A
		Precision	RPD \leq 30% or results within 2x the QL if \leq 5x QL	Method Duplicate	A
		Accuracy	Recovery 85-115%	Independent Calibration Verification	A
		Accuracy	75-125% Recovery for metals other than mercury	Check Calibration Verification	A
		Accuracy	75-125% Recovery unless limits set by CRM manufacturer	Certified Reference Material (CRM)	
		Sensitivity	Mean <QL; sample detection \leq MDL or MBs <1/10 th sample result or per lab SOP	Method Blank	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The above are based on Brooks Rand QCs. The assigned laboratory must meet all the measurement performance criteria, which assess the analytical DQIs, as specified in the applicable USEPA methods.

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Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group	PCB Aroclors				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	SW-846 8082	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the CRQL	Field Duplicates	S & A
		Accuracy and Precision	For Aroclors 1221 - 1254 recovery 70-130% and RPD \leq 10% per lab QCs.	MS/MSD	A
		Accuracy	Tetrachloro-m-xylene - 37-140% Decachorobiphenyl - 40-151%	Surrogates	A
		Accuracy	For Aroclors 1221 - 1254 recovery 70-130%, per lab QCs	Blank Spike	A
		Sensitivity	Sufficient to support QLs.	MDLs	A
		Sensitivity	Less than QLs	MB	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The assigned lab must meet all measurement performance criteria, which assess the analytical DQIs, as specified in the applicable USEPA method.

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Measurement Performance Criteria Table

Matrix	Sediment and Water (filter)				
Analytical Group	Total Organic Carbon (TOC) and Particulate Organic Carbon (POC)				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	USEPA Lloyd Kahn (USEPA Method 440.0 can be used as an alternate for POC)	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the CRQL	Field Duplicates	S & A
		Accuracy	Recovery 75-125%	Method Spike	A
		Precision	RPD \leq 20%	Laboratory Duplicate	A
		Accuracy	Recovery 80-120%	Blank Spike	A
		Sensitivity	< Detection Limit	Blank	A
		Completeness	>95% soil collection,	Data Completeness Check	S & A

1. The assigned lab must meet all the measurement performance criteria, which assess the analytical DQIs, as specified in the applicable USEPA method. If USEPA Method 440.0 is used to determine POC, the criteria in this method must be followed.

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Measurement Performance Criteria Table

Matrix	Water				
Analytical Group	TSS				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	USEPA 160.2 or equivalent Standard Method	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL	Field Duplicates	S & A
		Precision	RPD \leq 15% for duplicate values greater than or equal to 5 times the QL	Lab Duplicates	A
		Sensitivity	>QL or <1/10 th the sample result	Method Blank	A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The lab performing this test must meet the requirements in the applicable USEPA Method or Standard Method.

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Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group	Radiochemistry for Be-7, Cs-137 and K-40				
Concentration Level	Low				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
	HASL ² -300 or USEPA Method 600.4 80-032	Precision	RPD \leq 35% for duplicate values or with a difference $\leq 2 \times$ detection limit	Laboratory Duplicates	S & A
		Accuracy	Gamma Spectroscopy: <u>Detector Resolution</u> – within ± 0.4 Full Width at half maximum <u>Energy</u> – within ± 1 keV of the known energies Efficiency- 90-110% of the efficiency determined during initial calibration	Calibration Verification	A
		Accuracy	Gamma Spectroscopy: ± 3 standard deviations of the long-term average	Detector Background	A
		Completeness	>95% soil collection,	Data Completeness Check	S & A

1. The subcontract lab will be required to meet the above criteria. Rensselaer Polytechnic Institute in Troy, NY under the direction of Richard Bopp may be requested to perform confirmatory analyses on selected samples. Dr. Bopp's lab will follow the QCs in their internal SOP and their data will not require validation.

2. HASL = Health and Safety Laboratory

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Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group	Grain Size				
Concentration Level	NA				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria ¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
See Worksheet 21 for field sampling SOPs	ASTM D4464 or equivalent SOP	Precision	RPD $\leq 50\%$ for duplicate values	Field Duplicates	S & A
		Completeness	>95% laboratory analysis	Data Completeness Check	A

1. The lab performing this test must meet the requirements in the applicable ASTM Method or equivalent lab SOP.

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QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) -- Secondary Data Criteria used to Plan the Sampling Event and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Analytical data from the Lower Passaic River high resolution core program	USEPA sampling program conducted by Malcolm Pirnie, Inc, in 2005	USEPA. Sediment dating (Cs-137, Be-7) and contaminant concentrations (PCDD/F, PCBs, PAHs, Pesticides, Metals). Cores collected September 19, 2005 to October 12, 2005.	Determine chemical composition of the receptor in the mass balance model and representative chemical signatures for historical inventory to define resuspension component in mass balance.	Only 5 sediment cores were collected. No limitations on the use of this data set.
Water column large volume organic contaminants (particulate and dissolved phase data)	Lower Passaic River Large Volume Water Column Program, conducted by Malcolm Pirnie in 2005	USEPA. Dissolved and particulate concentrations of PCDD/F, PCB, Pesticides, collected October 6, 2005.	Determine contaminant content of solids transported in the Lower Passaic River water column to compare with recently deposited sediments.	Only a single sample collected. No PAHs were analyzed.
Water column organic and inorganic contaminant data	NJDOT Environmental Dredging Pilot Study in December 2005	Data collected by USGS for the Environmental Dredging Pilot Study in December 2005	Determine contaminant content of solids transported in the Lower Passaic River water column for environmental dredging pilot.	No limitations.

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Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Newark Bay Phase 1 Sediment Sampling Data	Tierra Solutions, Inc. (TSI)	TSI. Sediment chemistry collected as part of the Newark Bay Study Area Phase I Remedial Investigation (RI) from October to December 2005.	Characterize the Newark Bay source signature.	No limitation.
Dundee Dam sediment chemical data	USEPA	USEPA. Collected by Malcolm Pirnie, Inc. January 11, 2007. Sediment cores dated and analyzed for organic and inorganic contaminants.	Characterize the Upper Passaic River Source.	No limitation.
Tributary SPMD dissolved phase organic contaminants data	USEPA	USEPA. Malcolm Pirnie, Inc. Semi- quantitative dissolved concentrations for Pesticides, PAHs, PCBs and PCDD/F. Collected in October and November 2005	Characterize tributary source signature for organic chemicals.	Concentrations are semi-quantitative.
Tributary water column inorganic chemistry data	USEPA	USEPA. Malcolm Pirnie, Inc. Small Volume Water Column Program, conducted November 10, 2005 for inorganic analytes.	Characterize tributary sources for inorganic chemicals.	No limitations.

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Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Water quality data for organic and inorganic chemicals in CSO/SWO	New Jersey Department of Environmental Protection (NJDEP)	NJDEP. Data collected during the Contaminant Assessment Reduction Program (CARP) program between 2001 and 2004.	Characterize CSO/SWO source signatures for organic and inorganic chemicals.	Majority of the CSO samples are on the Hackensack River.

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QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) -- Summary of Study Tasks (Sediment)**Summary of Study Tasks (Sediment)**

Sampling Tasks: The field activities include the collection and analysis of surficial sediment samples, large volume water column suspended solids, and sediment cores.

The water column suspended solids and surficial sediment samples, to characterize external sources of contamination, will be collected in the Lower Passaic River tributaries [*i.e.*, above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or upriver of the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Surficial sediment samples, to characterize internal sources of contamination, will also be collected in the main stem of the Lower Passaic River (entire 17-mile of the river). Sediment cores will be collected above RM8 using piston coring devices. The program also include the collection of samples from CSOs and SWOs to be analyzed for suspended solids.

Analysis Tasks: These tasks include analyses performed on sediment and filter samples following the testing methodologies described in Worksheets 19 and 23.

Quality Control Tasks: The analytical and testing laboratories will be required to analyze QC samples listed in the documents and procedures given in Worksheet 28 and the applicable laboratory methods.

Secondary Data: Historical data available on the project data base.

Data Management Tasks: All data and field notes will be maintained in the Malcolm Pirnie, Inc. Corporate Office. See Worksheet 29 for discussion of data management.

Documentation and Records: All hardcopy data (field notebooks, photos, hard copies of COC forms, Airbills, etc.) will be taken to the Malcolm Pirnie, Inc. Corporate Office and kept in the files.

Assessment/Audit Tasks: SOPs will be reviewed prior to the performance of tasks. TSA to be performed of the split sampling activity per SOP No. 3 in Attachment 8. (See Worksheet 31.)

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Data Review Tasks: Verification of sampling and laboratory data. Laboratory data produced by USEPA-CLP labs will be validated by USEPA. Non-CLP chemical data that is generated will be validated by Malcolm Pirnie, Inc. data validators or subcontract data validators against the criteria in the applicable analytical SOPs. (See Worksheets 23, 28, 35, and 36)

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QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) -- Reference Limits and Evaluation Table
Reference Limits and Evaluation Table

Matrix: Sediment and Filters

Analytical Group: PCB Congeners by USEPA Method 1668A

Concentration Level: Low

Analyte ¹	Chemical Abstracts Services (CAS) Number	Study Action Limit ² (pg/g)	Study Quantitation Limit (pg/g)	Analytical Method		Achievable Laboratory Limits Axys Analytical 3,4	
				MDLs	QLs	MDLs (pg/g)	QLs (pg/g)
All individual Congeners PCB-1 through PCB-209	List is provided in Attachment 2	The lab QLs are set low enough to support the sample comparison	Equal to the lab achievable QLs for each congener	See USEPA Method 1668A	See USEPA Method 1668A	Sees summary in Attachment 2.1 based upon Axys MDLs for 10 gram sample.	0.1 to 2.0

- 1 See Attachment 2.1 for a list of PCB Congener statistically-derived MDLs determined by Axys Analytical Services, Inc. Attachment 2.2 is the list of co-eluting PCB congeners obtained by Axys Analytical.
- 2 A selected preliminary remediation goal for Total PCB of 660 nanogram/gram (ng/g) or 660,000 picogram/gram (pg/g) is given in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007).
- 3 Achievable QLs are expected to range from 0.1 to 2.0 pg/g, with exceptions (particularly for co-eluting congeners. The lab will be required to report congener and sample specific detection limits, which may be different.
- 4 Lab results will be in dry weight, depending on the sample moisture content and matrix effects, the actual QLs achieved may differ.

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Reference Limits and Evaluation Table**Matrix: Sediment and Filters****Analytical Group: Polychlorinated Dibenzodioxins and Dibenzofurans (PCDDs/PCFFs) by USEPA Method 1613B****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit (ng/kg)	Study Quantitation Limit ² (ng/kg)	Analytical Method (1613B)		Achievable Laboratory Limits Quantitation Limits (QLs)	
				MDLs (ng/kg) ¹	QLs (ng/kg) ³	MDLs (ng/kg) ¹	QLs (ng/kg) ⁴
2,3,7,8-TCDD	1746-01-6	Note 1	0.5	Note 3	1	0.031	0.1 - 0.5
1,2,3,7,8-PeCDD	40321-76-4	Note 1	2.5	Note 3	5	0.13	0.1 - 0.5
1,2,3,6,7,8-HxCDD	57653-85-7	Note 1	2.5	Note 3	5	0.19	0.1 - 0.5
1,2,3,4,7,8-HxCDD	39227-28-6	Note 1	2.5	Note 3	5	0.18	0.1 - 0.5
1,2,3,7,8,9-HxCDD	19408-74-3	Note 1	2.5	Note 3	5	0.17	0.1 - 0.5
1,2,3,4,6,7,8-HpCDD	35822-46-9	Note 1	2.5	Note 3	5	0.17	0.1 - 0.5
OCDD	3268-87-9	Note 1	5	Note 3	10	0.83	0.1 - 0.5
2,3,7,8-TCDF	51207-31-9	Note 1	0.5	Note 3	1	0.015	0.1 - 0.5
1,2,3,7,8-PeCDF	57117-41-6	Note 1	2.5	Note 3	5	0.095	0.1 - 0.5
2,3,4,7,8-PeCDF	57117-31-4	Note 1	2.5	Note 3	5	0.096	0.1 - 0.5
1,2,3,6,7,8-HxCDF	57117-44-9	Note 1	2.5	Note 3	5	0.091	0.1 - 0.5
1,2,3,7,8,9-HxCDF	72918-21-9	Note 1	2.5	Note 3	5	0.12	0.1 - 0.5
1,2,3,4,7,8-HxCDF	70648-26-9	Note 1	2.5	Note 3	5	0.093	0.1 - 0.5
2,3,4,6,7,8-HxCDF	60851-34-5	Note 1	2.5	Note 3	5	0.12	0.1 - 0.5
1,2,3,4,6,7,8-HpCDF	67562-39-4	Note 1	2.5	Note 3	5	0.099	0.1 - 0.5
1,2,3,4,7,8,9-HpCDF	55673-89-7	Note 1	2.5	Note 3	5	0.088	0.1 - 0.5
OCDF	39001-02-0	Note 1	5	Note 3	10	0.28	0.1 - 0.5

1. A selected preliminary remediation goal (PRG) of 0.002 ng/g or 2 ng/kg is given for 2,3,7,8-TCDD in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007). PRGs were not given for the other PCDDs/PCFFs.
2. The Project Quantitation Limits (PQLs) are target reporting limit goals in the 2005 QAPP and are based upon achievable QLs by Axys Analytical Services, Inc.
3. Specific MDLs for solids are not given in USEPA Method 1613B, but the QLs listed are the minimum levels published in Table 2 of USEPA1613B. The actual detection limits are usually dependent on the level of interference rather than instrument limitations.
4. Based upon Axys Analytical's achievable QLs. Lab results will be in dry weight; depending on the sample moisture content and matrix effects, the actual QLs may differ.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
 Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
 Revision Number 2, Revision Date: December 2007

Matrix: Sediment and Filters
Analytical Group: Chlorinated Pesticides by High Resolution Gas Chromatography-High Resolution Mass Spectrometry (HRGC/HRMS) (Axys MLA-028)
Concentration Level: Low

Analyte	CAS Number	Study Action Limit	Study Quantitation Limit (ng/g)	Analytical Method		Achievable Laboratory Limits Quantitation Limits (QLs)	
				MDLs	Method QLs	MDLs (ng/g) ²	QLs (ng/g) ²
alpha-BHC	319-84-6	Note 1	0.2	0.027	Not listed	0.027	0.01 -0.05
beta-BHC	319-85-7	Note 1	0.2	0.015	Not listed	0.015	0.01 -0.05
delta-BHC	319-86-8	Note 1	0.2	0.007	Not listed	0.007	0.01 -0.05
gamma-BHC	58-89-9	Note 1	0.2	0.012	Not listed	0.012	0.01 -0.05
Heptachlor	76-44-8	Note 1	0.2	0.024	Not listed	0.024	0.01 -0.05
Aldrin	309-00-2	Note 1	0.2	0.079	Not listed	0.079	0.01 -0.05
Heptachlor epoxide	1024-57-3	Note 1	0.2	0.014	Not listed	0.014	0.01 -0.05
Endosulfan I	959-98-8	Note 1	0.2	0.029	Not listed	0.029	0.01 -0.05
Dieldrin	60-57-1	4.3	0.2	0.019	Not listed	0.019	0.01 -0.05
4,4'-DDE	72-55-9	Note 1	0.2	0.009	Not listed	0.009	0.01 -0.05
4,4'-DDD	72-54-8	Note 1	0.2	0.008	Not listed	0.008	0.01 -0.05
4,4'-DDT	50-29-3	Note 1	0.2	0.010	Not listed	0.010	0.01 -0.05
2,4'-DDD	53-19-0	Note 1	0.2	0.008	Not listed	0.008	0.01 -0.05
2,4'-DDE	3424-82-6	Note 1	0.2	0.006	Not listed	0.006	0.01 -0.05
2,4-DDT	789-02-6	Note 1	0.2	0.008	Not listed	0.008	0.01 -0.05
Endrin	72-20-8	Note 1	0.2	0.031	Not listed	0.031	0.01 -0.05
Endosulfan II	33213-65-9	Note 1	0.2	0.057	Not listed	0.057	0.01 -0.05
Endosulfan sulfate	1031-07-8	Note 1	0.2	0.052	Not listed	0.052	0.01 -0.05
Methoxychlor	72-43-5	Note 1	0.2	0.005	Not listed	0.005	0.01 -0.05
Endrin ketone	53494-70-5	Note 1	0.2	0.029	Not listed	0.029	0.01 -0.05
Endrin aldehyde	7421-93-4	Note 1	0.2	0.027	Not listed	0.027	0.01 -0.05
alpha-Chlordane	5103-71-9	92	0.2	0.024	Not listed	0.024	0.01 -0.05
gamma-Chlordane	5103-74-2		0.2	0.015	Not listed	0.015	0.01 -0.05
Toxaphene ³	8001-35-2	Note 1	17	Note 3	Not listed	Note 3	Note 3

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
 Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
 Revision Number 2, Revision Date: December 2007

Matrix: Sediment and Filters**Analytical Group: Chlorinated Pesticides by High Resolution Gas Chromatography-High Resolution Mass Spectrometry (HRGC/HRMS) (Axys MLA-028)****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit	Study Quantitation Limit (ng/g)	Analytical Method		Achievable Laboratory Limits Quantitation Limits (QLs)	
				MDLs	Method QLs	MDLs (ng/g) ²	QLs (ng/g) ²
Hexachlorobenzene ⁴	118-74-1	Note 1	0.2	0.009	Not listed	0.009	0.01 -0.05

1. Selected pesticide preliminary remediation goals of 4.3 ng/g for Dieldrin, 91 ng/g for Total DDX, and 92 ng/g for Chlordane are given in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007). Preliminary remediation goals were not established for the other pesticides.
2. The laboratory achievable MDLs and QLs listed were determined by Axys Analytical by HRGC/HRMS similar to instrumentation employed for USEPA 1613B. A summary of the Axys method MLA-028 is provided in Attachment 6. Lab results will be in dry weight; depending on the sample moisture content and matrix effects, the actual lab QLs may differ.
3. Toxaphene detection limit is based upon the detection of the sum of the individual Toxaphene congeners. The sample specific detection limit range from the HRGC/HRMS method has been between 1 to 5 ng/g, which is sufficient to support the PQL of 17 ng/g.
4. Hexachlorobenzene, which is not considered to be a pesticide, has been included since Axys Analytical can detect it at low levels by their HRGC/HRMS pesticide method.
5. The Axys Analytical method MLA-028 can also provide data on additional pesticides that are not part of the components in the 2005 QAPP, which the laboratory will also report:

Additional Pesticides	CAS Number	Axys Analytical MDL (ng/g)	Axys Analytical QL (ng/g)
Oxychlordane	27304-13-8	0.043	0.01 -0.05
trans-Nonachlor	39765-80-5	0.021	0.01 -0.05
cis-Nonachlor	5103-73-1	0.027	0.01 -0.05
Mirex	2385-85-5	0.006	0.01 -0.05

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediment and Filters****Analytical Group: PAHs by Axys MLA-021 Gas Chromatography-Mass Spectrometry (GC/MS)****Concentration Level: Low**

Analyte ⁶	CAS Number	Study Action Limit ¹ (ug/kg)	Study Quantitation Limit ² (ug/kg)	Analytical Method ³		Achievable Laboratory Limits	
				MDLs (ug/kg)	QLs (ug/kg) ⁴	MDLs (ug/kg)	QLs(ug/kg) ^{4, 5}
Anthracene	120-12-7	Note 1	3.3	Note 3	0.1 - 1.0	0.41	0.1 - 1.0
Pyrene	129-00-0	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Benzo[g,h,i]perylene	191-24-2	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Benzo[e]pyrene	192-97-2	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Indeno[1,2,3-c,d]-pyrene	193-39-5	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Perylene	198-55-0	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Benzo[g,h,i]perylene	205-99-2	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Benzo[e]pyrene	192-97-2	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Fluoranthene	206-44-0	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Acenaphthylene	208-96-8	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Chrysene	218-01-9	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
2,3,5-Trimethylnaphthalene	2245-38-7	Note 1	3.3	Note 3	0.1 - 1.0	0.60	0.1 - 1.0
Benzo[a]pyrene	50-32-8	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Dibenzo[a,h]anthracene	53-70-3	Note 1	3.3	Note 3	0.1- 1.0	0.3 1	0.1- 1.0
Benzo[a]anthracene	56-55-3	Note 1	3.3	Note 3	0.1 - 1.0	0.18	0.1 - 1.0
2,6-Dimethylnaphthalene	581-42-0	Note 1	3.3	Note 3	0.1 - 1.0	0.31	0.1 - 1.0
Acenaphthene	83-32-9	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
1-Methylphenanthrene	832-69-9	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Phenanthrene	85-01-8	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
Fluorene	86-73-7	Note 1	3.3	Note 3	0.1 - 1.0	0.45	0.1 - 1.0
1-Methylnaphthalene	90-12-0	Note 1	3.3	Note 3	0.1 - 1.0	0.34	0.1 - 1.0
Naphthalene	91-20-3	Note 1	3.3	Note 3	0.1 - 1.0	1.5	0.1 - 1.0

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
 Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
 Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediment and Filters****Analytical Group: PAHs by Axys MLA-021 Gas Chromatography-Mass Spectrometry (GC/MS)****Concentration Level: Low**

Analyte ⁶	CAS Number	Study Action Limit ¹ (ug/kg)	Study Quantitation Limit ² (ug/kg)	Analytical Method ³		Achievable Laboratory Limits	
				MDLs (ug/kg)	QLs (ug/kg) ⁴	MDLs (ug/kg)	QLs(ug/kg) ^{4,5}
2-Methylnaphthalene	91-57-6	Note 1	3.3	Note 3	0.1 - 1.0	0.3 1	0.1 - 1.0
biphenyl	92-52-4	Note 1	3.3	Note 3	0.1 - 1.0	0.94	0.1 - 1.0
Benzo[b]fluoranthene	205-99-2	Note 1	3.3	Note 3	0.1 - 1.0	0.6 1	0.1 - 1.0
Benzo[j/k]fluoranthene	205-82-3, and 207-08-9	Note 1	3.3	Note 3	0.1 - 1.0	0.6 1	0.1 - 1.0
Dibenzothiophene	135-65-0	Note 1	3.3	Note 3	0.1 - 1.0	0.41	0.1 - 1.0

1. Selected preliminary remediation goals of 8,900 ug/kg for Low Molecular Weight PAHs and 65,000 ug/kg for High Molecular Weight PAHs are given in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007). The Low Molecular Weight PAHs include the sum of the concentrations of Acenaphthene, Acenaphthylene, Anthracene, Fluorene, 2-Methylnaphthalene, Naphthalene, and Phenanthrene. The High Molecular Weight PAHs include the sum of Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Dibenzo[a,h]anthracene, Fluoranthene and Pyrene.
2. The PQLs are based upon the target reporting limits in the 2005 QAPP.
3. There are no published method detection limits. The detection limits given are those based upon Axys Analytical MDL studies using Axys Analytical Method MLA-021. A summary of the method MLA-021 (MSU-009) is in Attachment 6.
4. These are the lab's estimated QLs.
5. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the sample moisture content and matrix effects.
6. The laboratory may also be asked to report concentrations of additional alkylated PAHs, which the Axys Analytical method is capable of detecting.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
 Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
 Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediment****Analytical Group: PCB Aroclors****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit (ug/kg) ¹	Target Study Quantitation Limit (ug/kg) ²	Analytical Method ³		Achievable Laboratory Limits	
				MDLs (ug/kg)	QLs (ug/kg)	MDLs (ug/kg)	QLs(ug/kg) ^{5,6}
Aroclor 1016	12674-11-2	NA	3.4	NA	NA	0.64	3.4
Aroclor 1221	11104-28-2	NA	3.4	NA	NA	2.0	3.4
Aroclor 1232	11141-16-5	NA	3.4	NA	NA	1.8	3.4
Aroclor 1242	53469-21-9	NA	3.4	NA	NA	1.1	3.4
Aroclor 1248	12672-29-6	NA	3.4	NA	NA	1.2	3.4
Aroclor 1254	11097-69-1	NA	3.4	NA	NA	1.6	3.4
Aroclor 1260	11096-82-5	NA	3.4	NA	NA	0.68	3.4
Aroclor 1262	37324-23-5	NA	3.4	NA	NA	Note 4	3.4
Aroclor 1268	11100-14-4	NA	3.4	NA	NA	Note 4	3.4
Total PCB (Sum of all the Aroclors)		660					

1. A preliminary remediation goal for total PCB of 660 ug/kg is given in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007).
2. The QLs and target PQLs are similar (3.4 vs.3.3 ug/kg) to the reporting limits in the August 2005 LPRRP QAPP.
3. Specific MDLs are not listed but the must at least meet the criteria given in USEPA Method SW-846-8082.
4. The achievable MDLs for the assigned lab must support the target QLs.
5. The target QLs are based upon reporting limits in the August 2005 LRRP QAPP and Accutest data, assuming a 30 gram sample extraction and a concentration of the extracts to a final volume of 2 mL. The actual achievable QLs based upon the assigned laboratory MDL studies may differ.
6. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the sample moisture content and matrix effects.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediment****Analytical Group: TOC by USEPA Lloyd Kahn Method****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit ¹ (mg/kg)	Study Quantitation Limit ² (mg/kg)	Analytical Method		Achievable Laboratory Limits ^{3,4}	
				MDLs	QLs	MDLs	QLs(mg/kg)
TOC	NA	NA	100	Not listed	Not listed	NA	100

1 An Action level has not been set for this Study.

2 The PQL listed is based upon the lab achievable QL.

3 The QL is based upon Accutest data. If another lab were assigned to perform this test their detection limits may differ.

4 Lab results will be in dry weight; depending upon the sample moisture content and matrix effects the actual QLs may differ.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediments****Analytical Group: TAL Metals plus Titanium and Mercury (ICP-AES and or ICP-MS plus CVAA⁶)****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit ¹ (mg/kg)	Target Study Quantitation Limit ² (mg/kg)	Analytical Method ³		Achievable Laboratory Limits	
				MDLs	Method QLs	MDLs (mg/kg)	Target QLs (mg/kg) ^{4,5}
Aluminum	7429-90-5	NA	20	NA	NA	1.4	20
Antimony	7440-36-0	NA	1	NA	NA	0.1	1
Arsenic	7440-38-2	NA	0.3	NA	NA	0.1	0.3
Barium	7440-39-3	NA	5	NA	NA	0.05	5
Beryllium	7440-41-7	NA	0.25	NA	NA	0.02	0.25
Cadmium	7440-43-9	NA	0.25	NA	NA	0.02	0.25
Calcium	7440-70-2	NA	500	NA	NA	1.0	500
Chromium	7440-47-3	NA	1	NA	NA	0.04	1
Cobalt	7440-48-4	NA	0.5	NA	NA	0.02	0.5
Copper	7440-50-8	80	1	NA	NA	0.04	1
Iron	7439-89-6	NA	10	NA	NA	0.3	10
Lead	7439-92-1	140	0.5	NA	NA	0.1	0.5
Magnesium	7439-95-4	NA	500	NA	NA	1.9	500
Manganese	7439-96-5	NA	0.5	NA	NA	0.03	0.5
Mercury	7439-97-6	0.72	0.03	NA	NA	0.022	0.033
Nickel	7440-02-0	NA	0.5	NA	NA	0.02	0.5
Potassium	7440-09-7	NA	500	NA	NA	3.4	500
Selenium	7782-49-2	NA	0.5	NA	NA	0.2	0.5
Silver	7440-22-4	NA	0.25	NA	NA	0.07	0.25
Sodium	7440-23-5	NA	500	NA	NA	1.3	500
Thallium	7440-28-0	NA	0.5	NA	NA	0.2	0.5
Titanium	7440-32-6	NA	100	NA	NA	0.04	100
Vanadium	7440-62-2	NA	0.5	NA	NA	0.1	0.5

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediments****Analytical Group: TAL Metals plus Titanium and Mercury (ICP-AES and or ICP-MS plus CVAA⁶)****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit ¹ (mg/kg)	Target Study Quantitation Limit ² (mg/kg)	Analytical Method ³		Achievable Laboratory Limits	
				MDLs	Method QLs	MDLs (mg/kg)	Target QLs (mg/kg) ^{4,5}
Zinc	7440-66-6	NA	1	NA	NA	0.1	1

1. Selected preliminary remediation goals of 80,000 ng/g (80 mg/kg) for copper, 140,000 ng/g (140 mg/kg) for lead and 720 ng/g (0.72 mg/kg) for mercury are given in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007).
2. The target PQLs are based upon the target reporting limits in the August 2005 QAPP with the exception of Arsenic, which is 0.3 mg/kg instead of 0.25 mg/kg, and mercury, which is 0.33 mg/kg instead of 0.3 mg/kg.
3. Method MDLs and QLs are not specified.
4. Metal MDLs and QLs listed are based upon Accutest data, and may differ slightly if another lab is assigned.
5. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the sample moisture content and matrix effects.
6. Cold Vapor Atomic Adsorption (CVAA)

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
 Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
 Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table

Matrix: Water - Suspended sediment (collected on filters)

Analytical Group: TAL Metals plus Titanium and Mercury (USEPA Methods 1638 and 1631)

Concentration Level: Low

Analyte	CAS Number	Study Action Limit ¹ (mg/kg)	Target Study Quantitation Limit ^{2,5} (mg/kg)	Analytical Method ³		Achievable Laboratory Limits	
				MDLs	Method QLs	MDLs (mg/kg)	Target QLs (mg/kg) ^{4,5}
Aluminum	7429-90-5	NA	7.0	NA	NA	2.3	7.0
Antimony	7440-36-0	NA	0.10	NA	NA	0.02	0.10
Arsenic	7440-38-2	NA	1.2	NA	NA	0.4	1.2
Barium	7440-39-3	NA	1.0	NA	NA	0.2	1.0
Beryllium	7440-41-7	NA	0.25	NA	NA	0.05	0.25
Cadmium	7440-43-9	NA	0.05	NA	NA	0.01	0.05
Calcium	7440-70-2	NA	150	NA	NA	30	150
Chromium	7440-47-3	NA	2.0	NA	NA	0.67	2.0
Cobalt	7440-48-4	NA	0.15	NA	NA	0.05	0.15
Copper	7440-50-8	80	1.0	NA	NA	0.17	1.0
Iron	7439-89-6	NA	25	NA	NA	6.5	25
Lead	7439-92-1	140	0.3	NA	NA	0.1	0.3
Magnesium	7439-95-4	NA	15	NA	NA	5	15
Manganese	7439-96-5	NA	0.20	NA	NA	0.07	0.20
Mercury	7439-97-6	0.72	0.0003	NA	NA	0.00003	0.0001
Nickel	7440-02-0	NA	1.0	NA	NA	0.3	1.0
Potassium	7440-09-7	NA	800	NA	NA	280	800
Selenium	7782-49-2	NA	1.0	NA	NA	0.31	1.0
Silver	7440-22-4	NA	0.10	NA	NA	0.03	0.10
Sodium	7440-23-5	NA	75	NA	NA	15	75
Titanium	7440-32-6	NA	1.0	NA	NA	0.2	1.0
Thallium	7440-28-0	NA	0.05	NA	NA	0.01	0.05

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
 Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
 Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table

Matrix: Water - Suspended sediment (collected on filters)

Analytical Group: TAL Metals plus Titanium and Mercury (USEPA Methods 1638 and 1631)

Concentration Level: Low

Analyte	CAS Number	Study Action Limit ¹ (mg/kg)	Target Study Quantitation Limit ^{2,5} (mg/kg)	Analytical Method ³		Achievable Laboratory Limits	
				MDLs	Method QLs	MDLs (mg/kg)	Target QLs (mg/kg) ^{4,5}
Vanadium	7440-62-2	NA	7.5	NA	NA	2.5	7.5
Zinc	7440-66-6	NA	1.0	NA	NA	0.2	1.0

1. Selected preliminary remediation goals of 80,000 ng/g (80 mg/kg) for copper, 140,000 ng/g (140 mg/kg) for lead and 720 ng/g (0.72 mg/kg) for mercury are given in Table A of the Draft Source Control Early Action Focused Feasibility Study (June 2007). The PQLs are based upon the projected lab capabilities.
2. Method MDLs and QLs are not specified.
3. Metal QLs listed are based upon Brooks Rand data by USEPA Methods 1638 and 1631 and are based upon a 0.5 gram sample. Depending upon the amount of solids actually collected on the filter, the detection limits may be lower. If another lab is assigned the detection limits may also differ.
4. The listed PQLs and QLs are on a wet-weight basis, while lab results will be in dry weight. Actual QLs may be higher and are dependent on the sample moisture content and matrix effects.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation
Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey
Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Sediment****Analytical Group: Radiochemistry by Gamma Spectroscopy****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit ¹ (pCi/g)	Target Study Quantitation Limit ² (pCi/g)	Analytical Method		Achievable Laboratory Limits ^{3,4}
				MDLs ³	Method QLs ³	Target Reporting Limit (pCi/g)
Beryllium-7	13966-02-4	NA ¹	0.3	NA	NA	0.3
Cesium-137	10045-97-3	NA ¹	0.05	NA	NA	0.05
Potassium-40	13966-00-2	NA ¹	1	NA	NA	1

1. There are no action levels established for these parameters for this Study.
2. The target PQLs are set at a low level intended to allow for dating of the sediment.
3. The target reporting limits are based upon OutReach Analytical data. If another lab were assigned to perform this test their detection limits may differ.
4. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the amount of sample available and counting time.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Water****Analytical Group: TSS****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit ¹ (mg/L)	Target Study Quantitation Limit ² (mg/L)	Analytical Method		Achievable Laboratory Limits ^{3,4}	
				MDLs ³	Method QLs ³	MDLs (mg/L)	QLs (mg/L)
TSS	NA	NA ¹	1 mg/L	Not listed	Not listed	NA	1

1. There is no action level for this parameter for this Study.
2. The PQL is based upon the lab's capabilities and a one liter sample.
3. QLs and MDL are based upon Accutest data. If another lab is assigned to perform this test their detection limits may differ.
4. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the sample moisture content and matrix.

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

Reference Limits and Evaluation Table**Matrix: Water****Analytical Group: Particulate Organic Carbon (POC)****Concentration Level: Low**

Analyte	CAS Number	Study Action Limit ¹ (mg/kg)	Study Quantitation Limit ² (mg/kg)	Analytical Method		Achievable Laboratory Limits ^{3,4}	
				MDLs ³	Method QLs ³	MDLs (mgkg)	QLs (mgkg)
POC	NA	NA ¹		Not listed	Not listed	To be determined (TBD)	TBD

1. There is no action level for this parameter for this Study.
2. The PQL is based upon the lab's capabilities.
3. QLs and MDL are based upon Accutest data. If another lab is assigned to perform this test their detection limits may differ.
4. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the sample moisture content and matrix.

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QAPP Worksheet #16 (UFP-QAPP Manual Section 2.8.2) -- Study Schedule / Timeline Table**Study Schedule Timeline Table**

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Planning and Development of Study Objectives	Malcolm Pirnie, Inc	Completed	Completed	Objectives	November 2007
Collection of samples and Submission for Analysis	Malcolm Pirnie, Inc	Projected to be in the winter of 2007	Estimated late 2007 into early 2008	Samples obtained per QAPP and shipped to assigned labs.	To be determined
Laboratory Data Analyses of sediment sample	Laboratories assigned	TBD	Radiochemistry for Be-7 should be completed in 2 weeks Other analyses should be completed within 35 days.	Data to Malcolm Pirnie, Inc. and subcontracted data validators	35 days after last sample is received
Validation Review and Verification of Sediment Data	Malcolm Pirnie, Inc and USEPA Region 2	TBD	TBD	Validated data reported	Approximately 2 months after the last laboratory report is issued
Evaluation of sample Data	Malcolm Pirnie, Inc	TBD	TBD	Data Evaluation Report	To be determined

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QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) -- Sampling Design and Rationale

Describe the study sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

Sampling Design and Rationale**Water Column Sampling****Sampling Process Design**

The planned Water Column Sampling from the tributaries and the Upper Passaic River, to characterize potential external sources of contamination, will take place at four sampling locations: Above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or upriver of the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Locations will be within the vicinity of the 2005 sampling locations for the SPMD deployments (described in Appendix D of the Draft Source Control Early Action Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.6).

Sampling Methods

The sampling procedures for the suspended matter sample follow the large volume water column sampling techniques in SOP 51 describing Trace Organics Platform Sampler (TOPS) sample collection and handling. Samples for TAL metals plus titanium and mercury analyses will be collected following SOP 52. Similar procedures were tested by Malcolm Pirnie, Inc. in 2005 (described in the Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.2). Total number of samples equals 24 samples (6 events \times 4 locations \times 1 suspended matter sample) plus QA/QC samples. Samples will be analyzed for POC, TSS, PCB congeners, PCDD/F, PAH, pesticides, and TAL metals plus titanium and mercury.

Sediments from Tributaries and the Upper Passaic River**Sampling Process Design**

The planned Sediment Sampling in the tributaries and Upper Passaic River, to characterize potential external sources of contamination, include locations above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or upriver of the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Locations will be within the vicinity of the 2005 sampling locations for the SPMD deployments (described in Appendix D of the Draft Source Control Early Action Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.6).

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Sampling Methods

The sampling procedures are as follows: At each location, collect six surface sediment samples using either a short-coring device or an Ekman dredge. See SOPs 24 and 50 describing sample collection and handling. Samples will represent sediment depth of 0-1 inch and have sufficient mass to analyze for the suite of parameters listed below. Total number of samples equals 24 samples (1 event \times 4 locations \times 6 sediment samples) plus QA/QC samples. Each selected sample will be analyzed for Be-7, Cs-137, K-40, TOC, grain size, and metals plus titanium and mercury. Eight samples (2 samples per tributary) that have detectable quantities (above target quantitation limit listed on Worksheet #15) of Be-7, representing a modern depositional environment, will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides.

Sediments from the Lower Passaic River**Sampling Process Design**

The planned Sediment Sampling on the Lower Passaic River, to characterize potential internal sources of contamination, will target twenty sampling locations, corresponding to some of the 2005 Be-7 field reconnaissance locations with detectable levels of Be-7 (refer to Attachment 4 of the December 23, 2005 Malcolm Pirnie, Inc. technical memorandum), and locations resulting from the proposed field reconnaissance using sediment probing techniques.

Sampling Methods

The sampling procedures are as follows: At each location, collect one surface sediment sample using either a short-coring device, piston core, or an Ekman dredge. See SOPs 24 and 50 describing sample collection and handling. Samples will represent sediment depth of 0-1 inch and have sufficient mass to analyze for the suite of parameters listed below. Total number of samples equals 20 samples (1 event \times 20 locations \times 1 sediment samples) plus QA/QC samples. Each sample will be analyzed for Be-7, Cs-137, K-40, TOC, grain size, and metals plus titanium and mercury. Eight selected samples that have detectable quantities of Be-7, representing a modern depositional environment, will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides.

Supplemental Sediment Coring**Sampling Process Design**

The sampling procedures for the Supplemental Sediment Coring of the Lower Passaic River above RM8, to characterize potential internal sources of contamination, will target 20 sampling locations, 3 of which correspond to Sedflume cores, previously collected.

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Sampling Methods

The sampling procedures for sediment coring above RM8 are as follows: At each location, collect 1 sediment core using a piston-coring device. Samples should be sub-sampled into two intervals, defined as 0-6 inches (below river bottom) and 6 inches to refusal, or until the background sediments are encountered. See SOP 50 describing sample collection and handling. Samples should have sufficient mass to analyze the suite of parameters listed below. Total number of samples equals 40 samples (1 event \times 20 locations \times 2 samples/location) plus QA/QC samples. Each sample will be analyzed for radiochemistry (Cs137 and K-40), TOC, grain size, PCB Aroclors, PCDD/F, PAHs, pesticides, and TAL metals. Samples will be used to characterize the contaminant inventories of the fine-grained sediment lenses above RM8; the top six inches are preliminarily considered the most likely to erode in a high-flow event.

CSO and SWO sampling**Sampling Process Design**

The Lower Passaic River CSO/SWOs discharge sampling, to characterize the chemical characteristics of recent suspended matter at CSO/SWO discharge sites, will be collected for four rainfall events. Two to four locations will be sampled per rainfall event. The four CSO locations will be chosen from 8 CSOs based on sewage drainage area, flow and access. The four SWO locations will be chosen from 8 to 10 SWOs based on pipe diameter, observed flow and access.

Sampling Methods

The CSO/SWOs discharge sampling procedures are as follows: At each location, collect large volume water samples will be collected using a peristaltic pump. Each sample will be analyzed for TSS, POC, grain size, PCB congener, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The filtration of the suspended solids will be performed by the laboratories. A multi-parameter sonde, or similar monitoring device will be used to measure pH, temperature, DO, redox potential and salinity (salinity will be used to determine if river water has been purged from the system during discharge.)

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QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) -- Sampling Locations and Methods/SOP Requirements Table

List all site locations that will be sampled and include sample/ID number, if available. (Provide a range of sampling locations of ID numbers if a site has a large number.) Specify matrix and, if applicable, depth at which samples will be taken. Only a short reference for the sampling location rationale is necessary for the table. The text of the QAPP should clearly identify the detailed rationale associated with each reference. Complete all required information, using additional worksheets if necessary

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference¹	Rationale for Sampling Location
Sample locations will be specified upon completion of field reconnaissance effort	Suspended Solids	Water Column (Depth in Water Column dependent upon sampling location)	Particulate Organic Carbon (POC), Total Suspended Solids (TSS), Polychlorinated Biphenyl (PCB) congeners, Polychlorinated Dibenzodioxins/Furans (PCDD/F), Polycyclic Aromatic Hydrocarbon (PAH), pesticides, and TAL metals plus titanium and mercury	Low	Total number of samples = 24 samples (6 events × 4 locations × 1 suspended matter sample) plus QA/QC samples	See SOP 51 and SOP52	Sample locations will be specified upon completion of field reconnaissance effort

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Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference¹	Rationale for Sampling Location
Locations will be within the vicinity of the 2005 sampling locations for the SPMD deployments (Figure 1 of Appendix A - FSP Addendum).	Surficial Sediment	Surface Grab samples 0-1 inch	Each sample will be analyzed for Be-7, Cs-137, K-40, TOC, grain size, and metals plus titanium and mercury. (Selected samples that have detectable quantities of beryllium-7, representing a modern depositional environment, will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides)	Low	Total number of samples = 24 samples (1 events × 4 locations × 6 sediment samples) plus QA/QC samples	See SOP 24	Sample locations will be specified upon completion of field reconnaissance effort

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Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference¹	Rationale for Sampling Location
Sample locations will be specified upon completion of reinterpretation of sidescan sonar sediment texture maps.	Sediment Cores	Sediment Core samples 0 feet to refusal, or until red brown clay is encountered whichever is first.	Each sample will be analyzed for Cs-137, K-40, TOC, grain size, PCB Aroclors, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury	Low	Total number of samples = 40 samples (1 event × 20 locations × 2 samples/location) plus QA/QC samples.	See SOP 50	Sample locations will be specified upon completion of field reconnaissance effort

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Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference¹	Rationale for Sampling Location
Four sample locations per rainfall sampling event. Sample locations will be chosen from 8 to 10 CSO and SWO based on sewage drainage area, flow and access.	Suspended solids	CSOs and SWOs grab sample	Each sample will be analyzed for POC, grain size, PCB congener, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury.	Low	Total number of samples: CSOs = 16 (4 event x min.) of 4 locations) SWOs = 16 (4 event x min. of 4 locations)	See SOP 54. Whole water samples will be collected in the field and the suspended solids will be filtered and analyzed by the laboratories. The samples for organic analyses will be filtered by a procedure (SLA-New) similar to the field filtration procedure in SOP 52. BrooksRand will filter the suspended solids for metals using 0.4 micron flat filters following SOP BRL-0107.	Sample locations will be determined based on sewage drainage area, flow and access.

¹Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #21).

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QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) -- Analytical SOP Requirements Table**Analytical SOP Requirements Table**

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/SOP Reference³	Sample Volume/Mass per Analysis	Containers (number, size, and type)^{1,2}	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Sediment	Congener PCBs	Low	USEPA Method 1668A	10 grams ³	4 oz. glass jar ⁴	Maintain in the dark at less than 4°C from time of collection until receipt at the lab or ship frozen on dry ice	If stored at less than -10°C solid multiphase samples can be stored for up to one year. Sample extracts can be stored at less than -10°C for up to one year
Sediment	PCDDs /PCDFs	Low	USEPA Method 1613B				
Sediment	Pesticides	Low	Axys Method MLA-028 (HRGC/HRMS similar to 1613B)			Cool to 4 °C ± 2°C or ship frozen on dry ice frozen	14 days to extraction, 40 days to analysis (For this study pesticide samples can be stored 299 days if frozen.)
Sediment	PAHs	Low	Axys Method MLA-021 (similar to SW846-8270)	10 grams	4 oz. glass jar	Cool to 4 °C ± 2°C or ship frozen on dry ice	14 days to extraction, 40 days to analysis (For this study PAH samples can be stored 199 days if frozen.)
Sediment	PCB Aroclors	Low	SW846-8082	30 grams (Supply 90 grams for QC)	4 oz. glass jar	Cool to 4 °C ± 2°C	14 days to extraction, 40 days to analysis
Sediment	TOC	Low	USEPA Method Lloyd Kahn	1 gram	4 oz. glass jar	Cool to 4 °C ± 2°C	28 days

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Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/SOP Reference³	Sample Volume/Mass per Analysis	Containers (number, size, and type)^{1,2}	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Sediment	TAL Metals plus Titanium and Mercury	Low	SW-846-6010B and 6020/7470A (The lab will use ICP-AES and if necessary ICP-MS, which ever given the better detection limits)	2 grams (must provide the lab at least 10 grams)	4 oz. glass or plastic jar	Cool to 4 °C ± 2°C	6 months for TAL Metals, 28 days for Mercury (For this study samples for metals other than mercury can be stored up to 1 year if frozen)
Sediment	Radiochemistry Be-7, Cs-137 and K-40	Low	HASL-300 EML or USEPA Method 4 80-032	If possible supply the lab at least 200 to 300 grams of wet sediment so >100 grams of dry sediment are available to be counted	16 oz. glass jar (4 oz in a sealed plastic bag for any confirmatory samples sent to Dr. Bopp's laboratory at Rensselaer Polytechnic Institute I for analyses)	NA	Be-7 should be counted as soon as possible or within month, since it has a short half-life. For this study Cs-137 and K-40 samples can be held up to 6 months.
Sediment	Grain size	Low	ASTM D4464 Laser Light Scattering	5 g	4 oz glass jar	Airtight container (do not freeze)	6 months

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Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/SOP Reference³	Sample Volume/Mass per Analysis	Containers (number, size, and type)^{1,2}	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water column suspended sediment collected on filter	Congener PCBs	Low	USEPA Method 1668A	Large volume (Est. 200 L) collected on filter(s). The actual volume collected will be dependent upon water turbidity. (CSO and SWO samples will be collected in multiple 4L bottles or other suitable containers. Suspended solids for analyses will be filtered by the laboratory. It is anticipated that 20 L samples may be collected to insure sufficient volume.)	Pre-cleaned Filter cartridge (0.5 micron) plus 0.7 micron flat filters	Cool to 4 °C ± 2°C Or store frozen	If stored at less than -10°C samples can be stored for up to one year. Sample extracts can be stored at less than – 10°C for up to one year
Water column suspended sediment collected on filter	PCDDs /PCDFs	Low	USEPA Method 1613B				
Water column suspended sediment collected on filter	Pesticides	Low	Axys Method MLA-028 (HRGC/HRMS similar to 1613B)				14 days to extraction, 40 days to analysis (For this study pesticide samples can be stored 299 days if frozen.)
Water column suspended sediment collected on filter	PAHs	Low	Axys Method MLA-021 (similar to modified SW846- 8270)				14 days to extraction, 40 days to analysis (For this study PAH samples can be stored 100 days if frozen.)

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Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/SOP Reference³	Sample Volume/Mass per Analysis	Containers (number, size, and type) ^{1,2}	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water column suspended sediment collected on filter Or sediment	TAL Metals plus Titanium and Mercury	Low	Modified USEPA Method 1638 and 1631 or equivalent methods	Volume filtered will be dependent upon water turbidity (CSO and SWO samples will be collected in 1 to 4L bottles and suspended solids will be filtered by the laboratory. Initially, 4 L samples will be collected for metals to insure sufficient sample volume.) (For sediment 0.5 gram)	Filter (0.4 micron) (For sediments 4 oz jar)	Cool to 4 °C ± 2°C Or store frozen	180 days And 28 days for Hg (if frozen one year)
Water	Total Suspended Solids	Low	USEPA Method 160.2 or equivalent Standard Method	1 Liter (the lab is request to filter the entire sample)	2 x I Liter	Cool to 4 °C ± 2°C	7 days

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Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/SOP Reference³	Sample Volume/Mass per Analysis	Containers (number, size, and type) ^{1,2}	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Particulate Organic Carbon	Low	USEPA Lloyd Kahn Method	Liter	2 x 1 Liter glass or plastic	Store at 4 °C \pm 2°C until filtration	Must be filtered within 7 days and filters analyzed within 7 days

1. The sample containers used for each chemical parameter must be certified as being clean or have been decontaminated by the laboratory.

2. The type and number of containers required may be adjusted to reflect the requirements of the individual laboratories selected to perform the analyses. The laboratories may allow combining analyses requested per jar to reduce the number of jars required.

3. Axys Analytical can perform the extraction of the PCB Congeners, PCDD/Fs and Pesticides on 10 grams of sediment sample. A single 4 oz. sample can be collected for these three parameters.

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QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) -- Field Quality Control Sample Summary Table

The following table(s) summarizes the number of field QC samples that will be collected and sent to the laboratory by matrix, analytical group, and concentration level.

Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS¹	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment	PCB Congeners	Low	USEPA Method 1668A	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Sediment	PCDD/F	Low	USEPA Method 1613B	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Sediment	Pesticides	Low	Axys Method MLA-028	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Sediment	PAHs	Low	Axys Method MLA-021 (similar to 8270)	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Sediment	PCB Aroclors	Low	SW846-8082	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP

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Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS¹	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment	TAL Metals plus Titanium and Mercury	Low	SW-846-6010B and 6020 plus 7470A	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Sediment	Radio-Chemistry (Be-7, Cs-137, and K-40)	Low	Gamma Spec HASL 300 EML	See Worksheet 18 and FSP ²	1 per 20 samples	NA	NA	NA	NA	See Worksheet 18 and FSP ²
Sediment	Total Organic Carbon	Low	USEPA Lloyd Kahn Method	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	NA	NA	See Worksheet 18 and FSP

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Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS¹	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment	Grain Size	NA	ASTM 4464 or equivalent	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	NA	NA	See Worksheet 18 and FSP
Water Column solids on filter	PCB Congeners	Low	USEPA Method 1668A	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Water Column solids on filter	PCDD/F	Low	USEPA Method 1613B	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Water Column solids on filter	Pesticides	Low	Axys Method MLA-028 By HRGC/HRMS	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Water Column solids on filter	PAHs	Low	Axys Method MLA-021 (similar to 8270)	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP

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Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS ¹	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Water Column solids on filter	TAL Metals plus Titanium and Mercury	Low	USEPA Methods 1631 and 1638	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Water	POC	Low	USEPA Lloyd Kahn Method on filtered sample	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP
Water	TSS	Low	USEPA Method 160.2 or equivalent Standard Method	See Worksheet 18 and FSP	1 per 20 samples	NA	NA	1 per event	NA	See Worksheet 18 and FSP

1. If MS/MSDs are required on solid samples, a separate sample is not required since they performed using a portion of the sample.
2. Selected sediment samples may also be submitted to Dr. Bopp's laboratory at Rensselaer Polytechnic Institute for confirmatory radiochemistry analyses.

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QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) -- Study Sampling SOP References Table

The following is a list of all SOPs associated with study sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody. Include copies of the SOPs as attachments or reference all in the QAPP. Sequentially number sampling SOP references in the Reference Number column. The reference number can be used throughout the QAPP to refer to a specific SOP.

Study Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Study Work?	Comments
SOP 1	Procedure to Conduct Sample Management for CLP and Non-CLP Samples, August 2006, Revision No. 0	Malcolm Pirnie, Inc.	Note book, personal computer, safety glasses, gloves, sample coolers, ice, sample labels, etc.	No	Attachment 3 to QAPP/FSP Addendum
SOP 2	Procedure to Conduct Sample Preservation	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 5 to QAPP/FSP Addendum
SOP 3	Procedure to Conduct a Technical System Field Audit, March, 2007, Revision No. 0	Malcolm Pirnie, Inc.	Note book, camera, and check list	No	Attachment 8 to QAPP/FSP Addendum
SOP 4	Procedure to Locate Sample Points Using a Global Positioning System (GPS)	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 9 to QAPP/FSP Addendum
SOP 7	Decontamination of Water Sampling Equipment	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 10 to QAPP/FSP Addendum
SOP 8	Procedure for Sediment Probing	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 11 to QAPP/FSP Addendum
SOP 20	Ultra-Clean Water Sampling Procedures for Mercury	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 12 to QAPP/FSP Addendum
SOP 21	Procedure for use of Horiba for Measuring Water Parameters	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 13 to QAPP/FSP Addendum
SOP 22	Management and Disposal of Investigation Derived Waste	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 14 to QAPP/FSP Addendum
SOP 24	Collecting Surface Sediments Using an Ekman or Ponar Dredge	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 15 to QAPP/FSP Addendum

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Study Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Study Work?	Comments
SOP 50	Hand Coring Devices	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 16 to QAPP/FSP Addendum
SOP 51	Trace Organics Platform Sampler (TOPS)	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 17 to QAPP/FSP Addendum
SOP 52	Field Filtration of Suspended Solids from Waters	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 18 to QAPP/FSP Addendum
SOP 53	Core Processing-Low Resolution Sediment Cores	Malcolm Pirnie, Inc.	Refer to Attachment	No	Attachment 19 to QAPP/FSP Addendum
SOP 54	Collection of Water Outfall Samples	Malcolm Pirnie Inc	Refer to Attachment	No	Attachment 20 to QAPP/FSP Addendum
SOP BRL-0107	Filtration for Collection of Particulate From Water Samples, 12/10/07, Revision 001	BrooksRand	Refer to Attachment	No	Attachment 21 to QAPP/FSP Addendum
SLA-New	Filtration of Large Volume Water Samples, Draft, 12/13/07	Axys Analytical	Refer to Attachment	No	Attachment 22 to QAPP/FSP Addendum

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QAPP Worksheet #22 (UFP-QAPP Manual Section 3.1.2.4) -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table**Field Equipment Calibration, Maintenance, Testing, and Inspection Table**

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Multi-Parameter Sonde such as the Horiba U-20 Multi-Parameter Water Quality Monitoring System or equivalent field instrument	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Horiba U-22 Multi-Parameter Water Quality Monitoring System Operation Manual	Field Team Leader	Attachment 13

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QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) -- Analytical SOP References Table

The following is a list all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP references in the Reference Number column. Include copies of the SOPs as attachments or reference in the QAPP. The reference number can be used throughout the QAPP to refer to a specific SOP.

Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Study Work?
USEPA Method 1668A	Method 1668, Revision A: Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/MRMS. USEPA-821-R-00-002. December 1999.	Definitive	PCB Congeners	HRGC/HRMS	Axys Analytical	No
USEPA Method 1613B	Method 1613, Revision B: Tetra through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS. October 1994.	Definitive	PCDD/F	HRGC/HRMS	Axys Analytical	No
Axys MLA-028	Determination of Organochlorine Pesticides by HRGC/HRMS, MLA-028, Rev. 2, August 2006	Definitive	Pesticides	HRGC/HRMS	Axys Analytical	No
Axys MLA-021 (Based upon a modified USEPA 8270, GC/MS)	Determination of Polycyclic Aromatic Hydrocarbons (PAH), Alkanes and Alkylated PAH In Sediment, tissue, Water, Hexane Extracts, XAD Resin and Filter Samples by GC/MS, Revision 2, March 2004	Definitive	PAHs	GC/MS	Axys Analytical	No
SW-846-8082	SW-846-8082, PCB Aroclors	Definitive	PCB Aroclors	Gas Chromatography Electron Capture detector (GC-ECD)	Accutest or alternately Test America	No

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Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Study Work?
USEPA Method 6010/6020/7470A	TAL Metals- methods SW-846 6010B, Inductively Coupled Plasma-Atomic Emission Spectrometry plus if necessary for some elements SW-846 6020, Inductively Coupled Plasma-Mass Spectrometry Mercury by SW-846-7470A, Mercury by Cold Vapor Atomic Adsorption Spectrometry	Definitive	TAL Metals/ Titanium/ Mercury On sediment	ICP-AES and ICP-MS for metals, Cold Vapor Atomic Adsorption (CVAA) for mercury	Accutest or alternately Test America	No
USEPA Method Lloyd-Kahn	USEPA Region II, Determination of Total Organic Carbon in Sediment, July 27, 1998	Definitive	Total Organic Carbon and Particulate Organic Carbon on filtered solids	Combustion	Accutest or alternately Test America	No
USEPA Methods 1631 and 1638	USEPA Method 1631, Revision E, Mercury by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, August 2002 USEPA Method 1638, Trace Elements by Inductively Coupled Plasma-mass Spectrometry (ICP-MS), January 1996	Definitive	Trace TAL Metals/ Titanium/ Mercury on water column filtered suspended sediment	Cold Vapor Atomic Fluorescence Spectrometry (CVAFS) And ICP-MS	Brooks Rand	Modified for solids
USEPA Method 160.2	USEPA Method 160.2 Total Suspended Solids on equivalent Standard Method	Definitive	Total Suspended Solids	Filtration	Accutest and Brooks Rand	No
ASTM 4464	ASTM 4464, Standard Test Method for Particle Size Distribution	Definitive	Grain Size	Laser Light Scattering	GeoSea or alternately Test America	No

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QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) -- Analytical Instrument Calibration Table**Analytical Instrument Calibration Table**

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference¹
HRGC/HRMS	Axys Analytical SOPs	Axys Analytical SOPs	Axys Analytical SOPs	Correct and Re-calibrate	Assigned Lab personnel	See Attachment 6 for summary of Axys SOPs
GC-ECD	SW-846 8082, and lab SOPs	SW-846 8082	See USEPA CLP SOW or SW-846 8082 and 8151A	See USEPA CLP SOW or SW-846 8082 and 8151A	Assigned Lab personnel	USEPA methods SW 846, 8082 and 8151A
GC/MS	Axys Analytical SOPs	Axys Analytical SOPs	Axys Analytical SOPs	Correct and Re-calibrate	Assigned Lab personnel	See Attachment 6 for summary of Axys SOPs
ICP-AES and ICP-MS	SW-846-6010B and 6020 and USEPA Method 1638	SW-846-6010B and 6020 and USEPA Method 1638	SW-846-6010B and 6020 and USEPA Method 1638	Correct and re-calibrate per SW-846-6010B and 6020 and USEPA Method 1638	Assigned Lab personnel	SW-846-6010B and 6020 and USEPA Method 1638 and assigned lab SOPs
CVAA	SW-846-7470A	SW-846-7470A	SW-846-7470A	Correct and re-calibrate per SW-846-7470A	Assigned Lab personnel	SW-846-7470A and assigned lab's SOP
CVAFS	USEPA Method 1638	USEPA Method 1638	USEPA Method 1638	Correct and re-calibrate per USEPA Method 1638	Assigned Lab personnel	USEPA Method 1638 and assigned lab's SOP
TOC Combustion Instrument	Per vendor instrument manual, and lab SOP	Check Daily	Per USEPA Lloyd Kahn method	Correct and Re-calibrate	Assigned Lab personnel	USEPA Region 2 Lloyd Kahn method

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Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference¹
Laser Light Scattering	Per vendor instrument manual, ASTM method 4464 and lab SOP	Per ASTM method 4464 and lab SOP	Per ASTM method 4464 and lab SOP	Correct and Re-calibrate	Assigned Lab personnel	ASTM method 4464

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QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.3) -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table**Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table**

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
See list of other Instruments given in Worksheet #24	See lab quality manual ^{2, 3}	See lab quality manual ²	See lab quality manual ²	See lab quality manual ²	See lab quality manual ²	Correct problems prior to analyzing study samples ²	The assigned subcontract lab	See SOPs listed in Worksheets 23 and 24 See Note 1

1. The maintenance of the analytical instruments including the testing activity, inspection activity, frequency, acceptance criteria, responsible person and SOP reference must be documented in the Laboratory's Quality Control Manual.
2. The subcontract lab(s) used for chemical analyses will be required to maintain a quality manual which meets National Environmental Laboratory Accreditation Conference (NELAC) requirements.
3. Availability of spare parts and maintenance of laboratory analytical instrumentation is the responsibility of the assigned subcontract laboratory.

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QAPP Worksheet #26 (UFP-QAPP Manual Appendix A) -- Sample Handling System

Use this worksheet to identify components of the study-specific sample handling system. Record personnel (and their organizational affiliations) who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection to laboratory delivery to final sample disposal. Indicate the number of days field samples and their extracts/digestates will be archived prior to disposal.

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): See Worksheet 21 for a list of the sample collection methods which are attached to this document.
Sample Packaging (Personnel/Organization): Malcolm Pirnie, Inc. Field Team
Coordination of Shipment (Personnel/Organization): Malcolm Pirnie, Inc. SMO
Type of Shipment/Carrier: Federal Express for Overnight Delivery or courier to the laboratory
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Assigned lab personnel
Sample Custody and Storage (Personnel/Organization): Assigned lab personnel
Sample Preparation (Personnel/Organization): Assigned lab personnel
Sample Determinative Analysis (Personnel/Organization): Assigned lab personnel
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples will not be stored in the field, but will be shipped within 24 hours of collection. If in an emergency they are stored in the field they will be kept in a cooler or transferred to a refrigerator kept at 4±2 degrees Celsius.
Sample Extract/Digestate Storage (Number. of days from extraction/digestion): Sample extraction and digestion must be conducted according to the analytical methods listed in Worksheet 19.
SAMPLE DISPOSAL
Personnel/Organization: Assigned Lab Sample Custodians
Number of Days from Analysis: At least 60 days

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Sample Handling and Custody

Sample custody procedures ensure the timely, correct, and complete analysis of each sample for all parameters requested. A sample is considered to be in someone's custody if it:

- Is in his/her possession.
- Is in his/her view, after being in his/her possession.
- Is in his/her possession and has been placed in a secured location.
- Is in a designated secure area.

Sample custody documentation provides a written record of sample collection and analysis. The sample custody procedures provide for specific identification of samples associated with an exact location and the recording of pertinent information associated with the sample, including time of sample collection and any preservation techniques, and a COC record, which serves as physical evidence of sample custody. Custody procedures will be similar to the procedures outlined in the USACE's Requirements for the Preparation of Sampling and Analysis Plans (USACE, 2001) and the USEPA's Contract Laboratory Program Guidance for Field Samplers (USEPA, 2007). The COC documentation system provides the means to individually identify, track, and monitor each sample from the time of collection through final data reporting. Sample custody procedures are developed for three areas: sample collection, laboratory analysis, and final evidence files, which are described below. SOP No. HW-32, "Implementing The National Strategy For Procuring Analytical Services For All OSWER Programs" issued in 2005 includes the Region 2 requirements for obtaining analytical services for Superfund projects, and outlines the arrangements that must be made through the USEPA Region 2 Regional Sample Control Coordinator (RSCC) and gives example forms which must be submitted.

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Field Sample Handling and Custody

Field records provide a means of recording information for each field activity performed at the site. COC procedures document pertinent sampling data and all transfers of custody until the samples reach the analytical laboratory. The sample packaging and shipment procedures summarized below will ensure that the samples arrive at the laboratory with the COC intact. Refer to SOP No. 1 in Attachment 3 for sample management information. Worksheet 19 lists the specific sample preservation requirements for each test method. Please refer to Section 2.3 of the August 2005 QAPP for a detailed discussion of sample handling.

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QAPP Worksheet #27 Chain of Custody Procedure

(UFP-QAPP Manual Section 3.3.3)

Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):
The field sample custody procedures including sample packing, shipment, and delivery requirements, are discussed in the text in Worksheets 17 and 26. Also, refer to Section 2.3 of the August 2005 QAPP and SOP No. 1 in Attachment 3 for sample management information.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):
Each laboratory will have a sample custodian who accepts custody of the samples and verifies that the information on the sample labels matches the information on the COC. The sample custodian will document any discrepancies and will sign and date all appropriate receiving documents. The sample custodian will also document the condition of the samples upon receipt at the laboratory. The laboratory sample custody procedures were discussed further in the following text.

Sample Identification Procedures: Each sample will be assigned a unique sample number using the Lower Passaic River Electronic Information Management System.

Chain-of-Custody (COC) Procedures:
A COC record will accompany the samples from the time of sampling through all transfers of custody. An examples COC form is presented in Attachment 4. The COC procedures are detailed in the following text and in SOP No. 1 in Attachment 3.

Chain of Custody Procedure

The COC form serves as an official communication to the laboratory detailing the particular analyses required for each sample. The COC record will accompany the samples from the time of sampling through all transfers of custody. It will be kept on file at the laboratory where samples are analyzed and archived. Three copies of the COC form are created; one copy is retained by the Field Team Leader and two are sent to the laboratory. An electronic copy of each COC should be also made and kept in the study directory. The SMO or designee completes a COC record to accompany each shipment from the field to the laboratory. In the case of CLP samples a copy of the COC created by Forms II Lite must be sent to the USEPA CLP Region 2 coordinator.

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The completed COC is put in a Ziploc® bag and taped to the inside cover of the sample shipping container. If there are more than one container in a shipment, copies of the COC forms will be placed in each container. The container is then sealed with custody seals and custody is transferred to the laboratory.

Transfer of Custody and Shipment

The custody of samples must be maintained from the time of sampling through shipment and relinquishment to the laboratory. Instructions for transferring custody are given below:

- All samples are accompanied by a COC. When transferring custody of samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC. This form documents sample custody transfer from the SMO or designee, through the shipper, to the analytical laboratory. Since a common carrier will usually not accept responsibility for handling COC forms, the name of the carrier is entered under “Received by,” the bill-of-lading number is recorded in the comments section, and the COC form is placed in a Ziploc® plastic bag and taped to the inside lid of the lead shipping cooler. Copies of the COC forms will be placed in each additional cooler in a shipment.
- Samples will be packaged for shipment and either picked up at the site by the laboratory or dispatched to the appropriate laboratory via overnight delivery service. SOP No. 1 in Attachment 3 contains the proper sample packaging techniques. A separate COC record must accompany each shipment. Shipping containers will be sealed for shipment to the laboratory. Two custody seals will be applied to each cooler to document that the container was properly sealed and to determine if the container was tampered with during shipment. The custody seals will be placed on the coolers in such a manner that the custody seal would be broken if the cooler were opened (*i.e.*, diagonally opposite corners of the cooler lid).
- The original COC will accompany the shipment. A copy will be retained by the Field Team Leader.

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- If the samples are sent by common carrier or air freight, proper documentation must be maintained. For example, the bill of lading must be retained by the Field Team Leader.

Laboratory Custody Procedures

The laboratory custody procedures will be equivalent to those described in the latest edition of the CLP Statement of Work (SOW).

The following procedures must be addressed in the laboratory custody SOP:

- A designated sample custodian accepts custody of the samples and verifies that the information on the sample labels matches the information on the COC. The sample custodian will document any discrepancies and will sign and date all appropriate receiving documents. The sample custodian will also document the condition of the samples upon receipt at the laboratory. The CLP laboratories will send a copy of the sample receipt checklist to USEPA's RSCC, while the subcontract laboratories will complete the form and return it electronically.
- Once the samples have been accepted by the laboratory, checked and logged in, they must be maintained in accordance with laboratory custody and security requirements.
- To ensure traceability of samples while in the possession of the laboratory, a method for sample identification that has been documented in a laboratory SOP will be used to assign sample numbers.
- The following stages of analysis must be documented by the laboratory:
 - Sample Extraction/Preparation.
 - Sample Analysis.
 - Data Reduction.

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- Data Reporting.
- Laboratory personnel are responsible for the custody of samples until they are returned to the sample custodian.
- When sample analyses and QA checks have been completed in the laboratory, the used portion of the sample must be stored or disposed of in accordance with the protocols specified in the CLP SOW or the subcontract agreement. Identifying labels, data sheets, COCs, and laboratory records will be retained until analyses and QA checks are completed in accordance with the protocols specified in the CLP SOW or the subcontract agreement.

Final Evidence Files

This is the final phase of sample custody. The COC records and sample analysis request form copies are archived in their respective study files. Laboratory custody forms, sample preparation and analysis logbooks, and data packages will become part of the laboratory final evidence file. Malcolm Pirnie, Inc. will archive other relevant documentation including records, reports, and correspondence, logs, pictures, and data review reports.

Sample Holding Times

Information on sample holding times and required preservation for each test method are provided in Worksheet 19.

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Sample Packaging and Shipping Requirements

Custody of samples must be maintained through the shipment of samples to the selected laboratory. All samples will be packaged and shipped at the end of each day unless other arrangements are made with the laboratory. Samples will be delivered directly to the laboratory by sampling personnel or shipped via the following procedure.

- Use waterproof high-strength plastic coolers only.
- After filling out the pertinent information on the sample label and tag put the sample in the bottle or vial and screw on the lid. Secure the lid with packaging tape.
- Place about 3 inches of inert cushioning material in the bottom of the cooler.
- Enclose the sample containers in clear plastic bags and seal bags. Place sample containers in the cooler in garbage bags in an upright position such that they do not touch and will not touch during shipment.
- Surround the samples with bags of ice (only samples that need to be preserved with ice). The ice should be repacked in Ziploc bags. Use enough ice to ensure the required preservation temperature ($4\pm 2^{\circ}\text{C}$) is maintained. Fill cooler with additional cushioning material if necessary.
- Place a temperature blank (40-mL vial filled with de-ionized water and label as “Temperature Blank”) into the cooler.
- If sending the samples by common carrier, sign the chain-of-custody under “Relinquished by,” enter the carrier name and air bill number, retain a copy for field records and put the chain-of-custody record in a waterproof plastic bag and tape it with packaging tape to the inside lid of the cooler. If sending the samples by courier or field team shipper, follow the above procedures, but also have the receiving carrier sign under “Received by.”
- Apply custody seal to front and back of cooler.
- Secure lid by taping. Do not cover any labels.

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- Attached complete shipping label to top of cooler. The shipping label shall have a return address. Any Department of Transportation (DOT) required labels or markings shall also be placed on the cooler.
- Ship the cooler by overnight express courier to the respective laboratory.
- Each cooler cannot exceed the weight limit set by the shipper (maximum 150 pounds for Federal Express).
- Custody forms for the samples will be signed by the field team member who is relinquishing custody. The custody form will include the air bill number, method of shipment, and time and date of the transfer of custody.
- Custody forms will be placed in a “Ziploc®” bag and enclosed in the shipping cooler.

Note: See SOP 1 for a description of the Sample Management and Custody Procedures as well as sample packing.

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QAPP Worksheet #28 QC Samples Table

(UFP-QAPP Manual Section 3.4)

QC Samples Table

Matrix	Sediment and filters					
Analytical Group	PCB Congeners					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	USEPA Method 1668A					
Sampler's Name	Malcolm Pirnie, Inc Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples per matrix	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL
Initial Calibration	At initial set up or when corrective is taken which may change calibration per USEPA Method 1668A	Per USEPA Method 1668A	Per USEPA Method 1668A	Assigned lab	Accuracy	Per USEPA Method 1668A

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QC Samples Table

Matrix	Sediment and filters					
Analytical Group	PCB Congeners					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	USEPA Method 1668A					
Sampler's Name	Malcolm Pirnie, Inc Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Calibration Verification	Prior to every 12 hr. period, but following Column Performance Solution and at end of 12 hr. period per USEPA Method 1668A	Per USEPA Method 1668A	Per USEPA Method 1668A	Assigned lab	Accuracy	Per USEPA Method 1668A
Laboratory Control Sample	Each group of 20 samples or less prior or analysis of samples	Per USEPA Method 1668A	Per USEPA Method 1668A	Assigned lab	Accuracy	Per USEPA Method 1668A
MB	Each time samples are extracted	Per USEPA Method 1668A	Per USEPA Method 1668A	Assigned lab	Sensitivity	Per USEPA Method 1668A
MDL	Annually	Per USEPA Method 1668A	Per USEPA Method 1668A	Assigned lab	Sensitivity	Per USEPA Method 1668A
The assigned laboratory must perform and meet all the quality assurance requirements specified in USEPA Method 1668A, including: performance of initial and ongoing studies, calibration verification, addition of internal standards, analyses of blanks and determination of detection limits. The lab personnel must follow all the corrective actions required by the USEPA Method 1668A. Axys Analytical Service's requirements for USEPA Method 1668A are given in Attachment 6.						

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QC Samples Table

Matrix	Sediment and filters					
Analytical Group	PCDD/F					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	USEPA 1613B					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples per matrix	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL
Initial Calibration	At initial set up or when corrective is taken which may change calibration per USEPA Method 1613B	Per USEPA Method 1613B	Per USEPA Method 1613B	Assigned lab	Accuracy	Per USEPA Method 1613B
Calibration Verification	Prior to every 12 hr. period, but following Column Performance Solution and at end of 12 hr. period per USEPA Method 1613B	Per USEPA Method 1613B	Per USEPA Method 1613B	Assigned lab	Accuracy	Per USEPA Method 1613B

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QC Samples Table

Matrix	Sediment and filters					
Analytical Group	PCDD/F					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	USEPA 1613B					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample	Each group of 20 samples or less prior or analysis of samples	Per USEPA Method 1613B	3 compounds may fail. Frequent failures must be investigated	Assigned lab	Accuracy	Per USEPA Method 1613B
MB	Each time samples are extracted	Per USEPA Method 1613B	Per USEPA Method 1613B	Assigned lab	Sensitivity	Per USEPA Method 1613B
MDL	Annually	Per USEPA Method 1613B	Per USEPA Method 1613B	Assigned lab	Sensitivity	Per USEPA Method 1613B
The assigned laboratory must perform and meet all quality assurance requirements specified in USEPA Method 1613B, including: performance of initial and ongoing studies, calibration verification, addition of internal standards, analyses of blanks and determination of detection limits. The lab personnel must follow all the corrective actions required by the USEPA Method 1613B. Axys Analytical Service's requirements for USEPA Method 1613B are given in Attachment 6.						

Project-Specific QAPP

Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

QC Samples Table

Matrix	Sediment and filters					
Analytical Group	Chlorinated Pesticides					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	Axys MLA-028 (see Attachment 6 for summary)					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples per matrix	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL
Initial Calibration	At initial set up or when corrective is taken which may change calibration per Axys MLA-028	Per Axys MLA-028	Per Axys MLA-028	Assigned lab	Accuracy	Per Axys MLA-028
Calibration Verification	Prior to every 12 hr. period, but following Column Performance Solution and at end of 12 hr. period per Axys MLA-028	Per Axys MLA-028	Per Axys MLA-028	Assigned lab	Accuracy	Per Axys MLA-028
MS/MSD	One per 20 samples	Recovery 40-120% RPD<30%	Investigate and note in case narrative	Assigned lab	Accuracy/ Precision	QAPP

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Title: QAPP/FSP Addendum for Lower Passaic River Restoration Study Empirical Mass Balance Evaluation

Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

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QC Samples Table

Matrix	Sediment and filters					
Analytical Group	Chlorinated Pesticides					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	Axys MLA-028 (see Attachment 6 for summary)					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample	Each group of 20 samples or less prior or analysis of samples	Per Axys MLA-028	3 compounds may fail. Frequent failures must be investigated per DLM02.2	Assigned lab	Accuracy	Per Axys MLA-028
MB	Each time samples are extracted	Per Axys MLA-028	Per Axys MLA-028	Assigned lab	Sensitivity	Per Axys MLA-028
MDL	Annually	Per Axys MLA-028	Per Axys MLA-028	Assigned lab	Sensitivity	Per Axys MLA-028
The assigned laboratory also must perform and meet all measurement performance criteria, which assess the analytical DQIs, as specified in Axys MLA-028 including: performance of initial and ongoing studies, calibration verification, addition of internal standards, analyses of blanks and determination of detection limits. Axys Analytical Service's requirements for MLA-028 are given in Attachment 6.						

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Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

Revision Number 2, Revision Date: December 2007

QC Samples Table

Matrix	Sediment and filters					
Analytical Group	PAHs					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	Axys MLA-021, modified 8270, see Attachment 6 for summary					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axys Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL
Lab Duplicates	1 per 20 samples	QAPP	Investigated and correct	Assigned Lab	Precision	RPD \leq 30% for duplicate values greater than or equal to 5 times the QL
MS/MSD or blank spike and duplicate blank spike	Each group of field samples in an SDG, or each SDG, whichever is most frequent per AXYS MLA-021	QAPP	Per AXYS MLA-021	Assigned lab	Accuracy/Bias and Precision	Recovery 40-120%, RPD <30% or Per AXYS MLA-021
Deuterated Monitoring Compounds	Each sample, standard, blank	Recoveries per AXYS MLA-021	Per AXYS MLA-021	Assigned lab	Accuracy/Bias	Per AXYS MLA-021
MB	Once every 12 hour for each instrument per AXYS MLA-021	Per AXYS MLA-021	Per AXYS MLA-021	Assigned lab	Sensitivity	Per AXYS MLA-021

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Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

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QC Samples Table

Matrix	Sediment and filters					
Analytical Group	PAHs					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	Axy's MLA-021, modified 8270, see Attachment 6 for summary					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Recommended Lab Axy's Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MDL	Annual	Per AXYS MLA-021	Per AXYS MLA-021	Assigned lab	Sensitivity	Per AXYS MLA-021
The assigned laboratory also must perform the QA/QC sample analyses and meet all the measurement performance criteria, which assess the analytical DQIs, as specified in AXYS MLA-021, such as laboratory duplicates and matrix spike duplicates for precision, matrix spikes, Deuterated monitoring compounds for accuracy, and blanks and method detection limits for sensitivity. The Axy's Analytical Services lab personnel must follow all the corrective actions required by the lab SOP.						

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Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

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QC Samples Table

	Sediments					
Analytical Group	TAL Metals/Titanium and Mercury					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	SW-846 6010/6020/7470A					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Accutest or other assigned Lab					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer and the reason for the deviation will be investigated.	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the QL
Laboratory Duplicates	1 per 20 field samples	SW-846 methods	Investigate and correct	Assigned Lab	Accuracy/Bias	RPD \leq 30% for mercury RPD \leq 20% for other metals
MS	Each Sample Delivery Group (SDG)	SW-846 methods	Investigate and correct	Assigned Lab	Accuracy/Bias	Recovery 75-125% for ICP-AES, 60-144% for Mercury, per lab QC limits for ICP-MS
Blank spike	Each Sample Delivery Group (SDG)	SW-846 methods	Investigate and correct	Assigned Lab	Accuracy/Bias	Recovery 80-120%
MB	Each Sample Delivery Group (SDG or at least every 20 samples	SW-846 methods	Investigate and correct	Assigned Lab	Sensitivity	Less than QLs

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QC Samples Table

	Sediments					
Analytical Group	TAL Metals/Titanium and Mercury					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	SW-846 6010/6020/7470A					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Accutest or other assigned Lab					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Detection Limits (MDLs)	Annually	SW-846 methods	Investigate and correct	Assigned Lab	Sensitivity	Low enough to support the QLs
The assigned laboratory also must perform all QA/QC sample analyses and meet all the measurement performance criteria, which assess the analytical DQIs, as specified in USEPA methods.						

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Site Name/Project Name: Lower Passaic River Restoration Project, Site Location: Newark, New Jersey

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QC Samples Table

	Water column suspended sediment on filters
Analytical Group	Trace TAL Metals/Titanium and Mercury
Concentration Level	Low
Sampling SOP	See Worksheet 21
Analytical Method/SOP Reference	USEPA Methods 1631 and 1638
Sampler's Name	Malcolm Pirnie Field Sampling Crew
Field Sampling Organization	Malcolm Pirnie Inc
Analytical Organization	Brooks Rand or other assigned Lab
No. of Sample Locations	See Worksheet 18

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer and the reason for the deviation will be investigated.	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD \leq 50% for duplicate values greater than or equal to 5 times the QL
Method Duplicates	In conjunction with MS/MSD samples and when necessary for mercury 1 per 10 client sample	Per 1631 and 1638	Investigate and correct, reanalyze samples	Assigned Lab	Precision	RPD \leq 30% for results within 2x the QL if $<5x$ QL
Independent Calibration Verification	1 per batch	Per 1631 and 1638	Correct problem prior to continuing analysis, recalibrate if necessary	Assigned Lab	Accuracy/Bias	Recovery 85-115%

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QC Samples Table

	Water column suspended sediment on filters
Analytical Group	Trace TAL Metals/Titanium and Mercury
Concentration Level	Low
Sampling SOP	See Worksheet 21
Analytical Method/SOP Reference	USEPA Methods 1631 and 1638
Sampler's Name	Malcolm Pirnie Field Sampling Crew
Field Sampling Organization	Malcolm Pirnie Inc
Analytical Organization	Brooks Rand or other assigned Lab
No. of Sample Locations	See Worksheet 18

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	3 per batch of samples	Per 1631 and 1638	Correct problem until criteria is met	Assigned Lab	Sensitivity	Mean <QO; sample detection \leq MDL or MBs <1/10 th sample result or per lab SOP
The assigned laboratory also must perform all QA/QC sample analyses and meet all the measurement performance criteria, which assess the analytical DQIs, as specified in USEPA methods.						

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QC Samples Table

Matrix	Sediment					
Analytical Group	PCB Aroclors					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	SW-846-8082					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Accutest or other assigned Lab					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD ≤40% for duplicate values greater than or equal to 5 times the CRQL
MS/MSD	Each SDG	Per SW-846-8082	If the limits at exceeded investigate	Assigned lab	Accuracy/Bias and Precision	For Aroclors 1212-1254 70- 130% and RPD ≤10% per lab QCs
Surrogate	Each sample, standard, blank	Per SW-846-8082	If the limits at exceeded investigate and correct	Assigned lab	Accuracy/Bias	Tetrachloro-m-xylene - 37- 140% Decachorobiphenyl - 40-151%
MB	Once every 12 hour for each instrument per SOM01.2	Per SW-846-8082	If the limits at exceeded investigate and correct	Assigned lab	Sensitivity	Less than QLs
The assigned laboratory also must perform the QA/QC sample analyses and meet all the measurement performance criteria, which assess the analytical DQIs, as specified in USEPA method, such as laboratory duplicates and matrix spike duplicates for precision, matrix spikes, Deuterated monitoring compounds for accuracy, and blanks and method detection limits for sensitivity.						

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QC Samples Table

Matrix	Water					
Analytical Group	TSS					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	USEPA Method 160.2 or Standard Method					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Accutest or other assigned lab					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal 5 Xs the QL
Laboratory Duplicates	Per sample batch	USEPA Method 160.2 and per lab SOP	Investigate and Recalibrated is necessary	Assigned lab	Precision	RPD \leq 15% for duplicate values greater than or equal 5 Xs the QL
Method Blank	1 per batch	USEPA Method 160.2 and per lab SOP	Investigate problem and correct	Assigned lab	Sensitivity	<QL or <1/10 th the sample result

1. The laboratory must follow all the QC criteria in the applicable USEPA Method or Standard Method.

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QC Samples Table

Matrix	Sediment and Water					
Analytical Group	TOC and POC					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	USEPA Lloyd Kahn					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Accutest or other assigned lab					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD \leq 40% for duplicate values greater than or equal to 5 times the CRQL
Lab duplicates	1 per 20 field samples	USEPA Lloyd Kahn and per lab SOP	Investigate and correct	Assigned lab	Precision	RPD \leq 20%
MS	Per sample batch	USEPA Lloyd Kahn and per lab SOP	Investigate –record in case narrative	Assigned lab	Accuracy and Precision	Recovery 75-125%
Blank Spike	Per sample batch	USEPA Lloyd Kahn and per lab SOP	Investigate and correct	Assigned lab	Accuracy	Recovery 80-120%
Blank	Per sample batch	USEPA Lloyd Kahn and per lab SOP	Investigate and correct	Assigned lab	Sensitivity	<Detection Limit
MDL	Annual	QAPP	Investigate and correct	Assigned lab	Sensitivity	Low enough to support the QLs

1. The assigned lab must perform and meet all the measurement performance criteria, which assesses the analytical DQIs, as specified in the applicable USEPA method.

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QC Samples Table

Matrix	Sediment					
Analytical Group	Radiochemistry for Be-7, Cs-137 and K-40					
Concentration Level	Low					
Sampling SOP	Worksheet 21					
Analytical Method/ SOP Reference	HASL-300 or USEPA 600 4 80-032					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	OutReach Analytical					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Lab Duplicates	1 per 20 field samples	QAPP	If the limit exceed investigate and correct	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD<35% for duplicate values or with a difference <2 x detection limit
Calibration verification	Per sample batch	Per lab SOP	If the limit exceed investigate and correct	Assigned lab	Accuracy	Gamma Spectroscopy: <u>Detector Resolution</u> – within ±0.4 Full Width at half maximum <u>Energy</u> – within ± 1keV of the known energies Efficiency- 90-110% of the efficiency determined during initial calibration
Detector Background	1 per 20 field samples		Investigate and correct	Assigned lab	Accuracy	Gamma Spectroscopy: ±3 standard deviations of the long-term average

1. The subcontract lab will be required to meet the above criteria. If Dr. Bopp's laboratory at Rensselaer Polytechnic Institute performs confirmatory analyses, they will follow the QCs in their internal SOP.

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QC Samples Table

Matrix	Sediment					
Analytical Group	Grain Size					
Concentration Level	Low					
Sampling SOP	See Worksheet 21					
Analytical Method/ SOP Reference	ASTM D4464 or equivalent lab SOP					
Sampler's Name	Malcolm Pirnie Field Sampling Crew					
Field Sampling Organization	Malcolm Pirnie Inc					
Analytical Organization	Accutest or other assigned lab					
No. of Sample Locations	See Worksheet 18					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	1 per 20 field samples	QAPP	If the limits exceed limits for the field replicate, this will be addressed by the Malcolm Pirnie Data Reviewer	Malcolm Pirnie Field Team Leader and or Laboratory	Precision	RPD \leq 50% for duplicate values greater than or equal 5 Xs the QL

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QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) -- Study Documents and Records Table

Identify the documents and records that will be generated for all aspects of the study including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment.

Study Documents and Records Table

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Notes and or Data Sheets	Sample collection and custody records.	Copies of field notes and Chain of Custody (COC) records will be made and stored in the study files.	Field Sampling Audit Check List	Prepared and submit to Study Team
Air bills	Air bills	Copies of Air Bills will be kept in study files.	Study Records	
Analytical and Testing Sample Data Packages	Custody records	Copies of all analytical data deliverables stored in lab and transferred to study files, including instrument calibration records and raw data stored electronically or in hardcopy.	QA Review sheet	
Data Validation Reports for any subcontract lab chemical data	Custody records	Stored in study files	QA Review sheet	
Draft Final Summary Report		Stored in the study files at Malcolm Pirnie, Inc.		Prepared and submit to Study Team

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Data Management

This section describes the study data management process, tracing the path of the data from their generation to their final use or storage. All Study data and information must be documented in a format useable to the Study personnel.

Study Document Control System

Study documents will be controlled by the Malcolm Pirnie PM and the Technical DPM, who will maintain and distribute the hardcopies and electronic copies of the Study documents and including any amendments. Electronic copies of Study information will be maintained in the Study directory on the server in the Malcolm Pirnie, Inc. Corporate Headquarters, which is backed up at least once per day.

Data Recording

Data for this Study will be electronically captured or collected by handwritten entries and will be recorded onto field logbooks or forms. Computer-generated data associated with laboratory analyses will be managed under the control of the assigned USEPA-CLP or subcontract laboratory's laboratory information management system (LIMS). Requirements for the LIMS software can be found in the individual laboratories QA documentation. Subcontract laboratories providing the chemical data will provide the data in an Electronic Data Deliverable (EDD) format.

Types of Study Documentation and Records

1. Sample Collection and Field Measurement Records included items such as:
 - a. Field data collection or sampling data sheets or field notes.
 - b. COC records.
 - c. Air bills.

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- d. Communications logs, records or copies of pertinent e-mails.
 - e. Corrective action reports and results.
 - f. Documentation of field modifications.
 - g. Field instrument records.
 - h. Drilling logs.
2. Analytical Records including items such as:
- a. COC records.
 - b. Sample receipt records.
 - c. Records of sample preparation and analysis.
 - d. Instrument calibration records.
 - e. Raw data files.
 - f. Electronic Data Deliverables (EDD).
 - g. Analytical Results and supporting data.
 - h. Sample Data Packages.
3. Study Data Assessment Records such as:
- a. Technical System Field Audits.
 - b. Data Validation Reports.

Data Quality Assurance Checks

Malcolm Pirnie will monitor the progress of sample collection to verify that samples are collected as planned. The progress of sample collection and processing will be monitored through documentation of the samples collected each day.

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The contracted laboratory (either CLP or non-CLP) will have a formal in-house QA Plan to which it adheres and performs as part of daily operations. Data generation processes will be reviewed and modified to meet objectives, if necessary. A formalized data generation procedure will be utilized. Each analyst must have previously demonstrated, through the laboratory QA program, his or her ability to generate acceptable results within the requirements of the each method.

Laboratory Data Transmittal

Laboratory data are managed by the laboratory's LIMS system, beginning with sample check-in on the sample-receiving data terminal. For non-CLP laboratories, full laboratory data reports will be delivered to Malcolm Pirnie, Inc. within 35 days of the laboratory's receipt of the each sample delivery group (SDG), and will include EDDs. In addition, Region 2 requires that non-CLP laboratories adhere to the Analytical Services Tracking System (ANSETS) reporting requirements, which utilize the ANSETS Data Requirement form. Detailed instructions and procedures can be obtained by contacting the USEPA Region 2 Regional Sample Control Coordinator, Ms. Jennifer Feranda, at 732-321-6687 or feranda.jennifer@epa.gov, or Mr. Adly Michael at 732-906-6161 or Michael.adly@epa.gov. For CLP laboratories, third-party validated laboratory results will be received by Malcolm Pirnie through the USEPA RSCC, and will include EDDs.

Data Storage and Retrieval

Paper copies of the forms, an electronic copy of files, and the photographic log will be transmitted regularly to the Malcolm Pirnie, Inc. Technical DPM. The completed forms and notebooks will be stored in the custody of the Technical DPM for the duration of the Study. The full laboratory data reports submitted to Malcolm Pirnie, Inc. will be stored in the custody of the SQO. The laboratory will maintain copies of documents and magnetic tape backups of all data associated with the analyses of samples. Raw data and electronic media of all field samples, including QC samples and blanks will be archived from the date of generation and will be kept by the laboratory per the requirements of USEPA-CLP. Hard copies of Study files will be archived off-site at a secure facility and retained

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until the end of the contract; project closeout will be conducted in accordance with USEPA Close-out Guidelines. Data will be transferred to the USACE-KC and USEPA upon completion of the Study. Retrieval of data by others will be at the discretion of the USACE-KC and the USEPA. The length of time that records will be archived will be at the discretion of the USACE-KC and USEPA. Each laboratory shall archive, electronically, the sample analyses and submit the electronic data files along with the data deliverable package. In addition, each laboratory must submit instrument manufacturer, method files and ID file information. Malcolm Pirnie, Inc. must receive this information in the event a lab on this Study closes or updates hardware/software.

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QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) -- Analytical Services Table

Identify all laboratories or organizations that will provide analytical services for the study, including on-site screening, on-site definitive, and off-site laboratory analytical work. Group by matrix, analytical group, concentration, and sample location or ID number. If applicable, identify the subcontractor laboratories and backup laboratory or organization that will be used if the primary laboratory or organization cannot be used.

Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory Organization (Name and Address, Contact Person and Telephone Number)
Sediment and water column filters	PCB Congeners, PCDD/F, Chlorinated Pesticides and PAHs	Low	See Worksheet 18 and the FSP	USEPA Methods 1668A, 1613B, and Axys Methods	35 days	Axys Analytical, BC Canada Pam Riley 250-655-5800	A backup lab has not been assigned at this time.
Sediment	PCB Aroclors	Low	See Worksheet 18 and the FSP	SW-846-8082	35 days	Accutest Laboratories 2235 Route 10 Dayton, NJ 00810 Steve Grant 732-329-0200, ext. 252	Test America Burlington, Vermont Jim Madison 802-660-1990
Sediment	TOC	Low	See Worksheet 18 and the FSP	USEPA Lloyd. Kahn Method	35 days	Accutest Laboratories 2235 Route 10 Dayton, NJ 00810 Steve Grant 732-329-0200, ext. 252	Test America Burlington, Vermont Jim Madison 802-660-1990
Water	POC	Low	See Worksheet 18 and the FSP	USEPA Lloyd. Kahn Method	35 days	Accutest Laboratories 2235 Route 10 Dayton, NJ 00810 Steve Grant 732-329-0200, ext. 252	Test America Burlington, Vermont Jim Madison 802-660-1990

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Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory Organization (Name and Address, Contact Person and Telephone Number)
Water column suspended sediment collected on filters	TAL Metals, Titanium and Mercury	Trace	See Worksheet 18 and the FSP	USEPA Method 1631 and USEPA Method 1638	35 days	Brooks Rand 3958 6 th Ave NW Seattle, WA 98107 Colin Davies 206-632-6206	A backup lab has not been assigned at this time.
Water	TSS	Low	See Worksheet 18 and the FSP	EPA 160.2 or SM 2540D	35 days	Accutest Laboratories 2235 Route 10 Dayton, NJ 00810 Steve Grant 732-329-0200, ext. 252 Or Brooks Rand 3958 6 th Ave NW Seattle, WA 98107 Colin Davies 206-632-6206	Test America Burlington, Vermont Jim Madison 802-660-1990
Sediment	TAL Metals, Titanium and Mercury	Low	See Worksheet 18 and the FSP	SW-846-6010B/6020 and 7470A	35 days	Accutest Laboratories 2235 Route 10 Dayton, NJ 00810 Steve Grant 732-329-0200, ext. 252	Test America Burlington, Vermont Jim Madison 802-660-1990
Sediment	Radiochemistry	Low	See Worksheet 18 and the FSP	HASL-300 EML	35 days with rush analyses on samples for Be-7	Ron Edison OutReach Analytical 311 North Aspen Broken Arrow, OK 74012	Dr. Richard Bopp's laboratory at Rensselaer Polytechnic Institute may perform confirmatory analyses.

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Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory Organization (Name and Address, Contact Person and Telephone Number)
Sediment	Grain Size	NA	See Worksheet 18 and the Appendix A – FSP Addendum	ASTM 4464 Laser Light Scattering	35 days	GeoSea Consulting Ltd. 7236 Peden Lane, Brendwood Bay, BC Canada V8M 1C5 Dr. Patrick McLaren 250-652-1334	A backup lab has not been assigned at this time

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QAPP Worksheet #31 (UFP-QAPP Manual Section 4.1.1) -- Planned Study Assessments Table

Identify the type, frequency, and responsible parties of planned assessment activities that will be performed for the study.

Planned Study Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Field Safety Audit	Initially within the first week of field work	Internal	Malcolm Pirnie Inc	Malcolm Pirnie Project Safety Officer	Malcolm Pirnie PM	Malcolm Pirnie PM or designees	Malcolm Pirnie PSO
Technical System Internal Audit of Field Sampling Procedures	Initially within the first few weeks	Internal	Malcolm Pirnie Inc	Malcolm Pirnie Site Quality Officer	Malcolm Pirnie PM	Malcolm Pirnie PM or designees	Malcolm Pirnie SQO

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QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) -- Assessment Findings and Corrective Action Responses

For each type of assessment describe procedures for handling QAPP and project deviations encountered during the planned study assessments.

Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Technical System Field Audits (TSAs)	See TSA report SOP in Attachment 8	SQO, PM or designees, Malcolm Pirnie Inc	Within week	See below section on Field Corrective Actions	Field Team Leader and Project Manager	Within week
Internal Lab Audits	Per Laboratory Quality Manual	Laboratory Management or designee	Annually	Per Laboratory Quality Manual	Laboratory Personnel	Per Laboratory Quality Manual

Non-Conformance/QC Reporting

A non-conformance is defined as an identified or suspected deficiency or discrepancy with regard to an approved document (*e.g.*, improper sampling procedures, improper instrument calibration, calculation, computer program); or an item where the quality of the end product itself or subsequent activities using the document or item would be affected by the deficiency; or an activity that is not conducted in accordance with the established plans or procedures.

Any staff member engaged in Study work that discovers or suspects a non-conformance is responsible for initiating a non-conformance report to the SQO. The SQO will evaluate each non-conformance report and the SQO will provide a disposition which describes the actions to be taken.

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The PM will verify that no further study work dependent on the nonconforming item or activity is performed until approval is obtained and the non-conformance is properly addressed. If the non-conformance is related to material, the PM shall be responsible for making or identifying, with the non-conformance report number, the nonconforming item (if practical) and indicating that it is nonconforming and is not to be used.

A copy of each non-conformance report will be included in the Study file. Copies of all non-conformances shall be maintained by the SQO.

Assessment

This element addresses assessment of the effectiveness of the Study implementation and associated QA/QC activities.

Assessment and Response Actions

To monitor the capability and performance of the field activities, several types of audits will be performed. These audits will be conducted by the SQO or designee. Performance audits (PAs) of laboratories are conducted to measure the accuracy of the measurement systems. Data Quality Audits (DQAs) are conducted to determine if the data generated by the sampling and analysis satisfy the DQOs.

Technical System Audits (TSAs)

Field audits will be conducted on an ongoing basis during the Study as field data are generated, reduced, and analyzed. Numerical manipulations, including manual calculations, will be documented. Records of numerical analyses will be legible, of reproduction-quality, and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator. System audits of Site activities will be accomplished by an inspection of field Site activities. During this audit, the auditor(s) will compare current field practices with standard procedures. The following elements will be evaluated during a TSA:

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- Whether procedures and analyses are conducted according to procedures outlined in the QAPP.
- Whether proper sample documentation is being recorded.
- The level of QC conducted by the field team.
- Decontamination procedures, where applicable.
- Sample packaging and shipment.

TSA's are conducted for each field sampling task to determine if the system is capable of producing data that meet the DQOs. As long as the field team(s) demonstrate proficiency in the sampling procedures being audited, a follow-up audit will not be required. However, if the audit indicates the need for corrective action, a second TSA will be required. Any minor deficiencies that are noted during the TSA will be corrected in the field as they occur. If major deficiencies are noted (*i.e.*, those that cannot be immediately corrected in the field), a Stop-Work Order will be issued until appropriate measures can be taken to correct the problem. A Stop-Work Order may be issued by the SQO, following notification to the PM. The conditions and the need for a Stop-Work Order will be documented in sufficient detail to permit evaluation of the deficiency and determination of proper corrective action(s). Pertinent communications with the SQO, Field Team Leader, Task Leader, and PM that pertain to an evaluation of the problem along with potential solutions and their implementation will be attached to the Stop-Work Order. In order for work to resume, following a Stop-Work Order, the Malcolm Pirnie PM and SQO must rescind it in writing. The SQO is responsible for tracking non-conforming conditions, evaluating the effectiveness of corrective measures, and assuring that the necessary steps have been taken to prevent recurrence of the original problem.

Regardless of whether major, minor, or no deficiencies were noted during the audit, a written report of the TSA will be prepared by the SQO and submitted to the Malcolm Pirnie, USEPA, and USACE-KC PMs, as well as the Field Team Leader and the field team. This report will identify any deficiencies found and will outline the corrective actions that were recommended/implemented to address them. A copy of SOP No. 3 on conducting a TSA is found in Attachment 8. Periodically during the audit, it may be determined that

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the Site program should be modified to increase data quality or efficiency. These modifications will be documented by the Malcolm Pirnie PM or SQO in a Field Modification Form. An example of this form can be found in Attachment 7.

Field Corrective Actions

At the end of each sampling day, the sampling team is to report any problems requiring corrective action that were encountered during the day. Corrective action will be undertaken when a non-conforming condition is identified. A non-conforming condition occurs when QA objectives for precision, accuracy, completeness, representativeness, or comparability are not met, or when procedural practices or other conditions are not acceptable. A report is to be filed that documents the problems encountered and the corrective action implemented. A Stop-Work Order may be issued by the SQO, following notification to the PM, if corrective action does not adequately address a problem, or if no resolution can be reached.

Internal Laboratory Audits

As part of its QA program, the Laboratory Quality Assurance Manager (QAM) will conduct periodic checks and audits of the analytical systems to ensure that the systems are working properly and personnel are adhering to established procedures and documenting the required information. These checks and audits will also assist in determining or detecting where problems are occurring. In addition to conducting internal reviews and audits, as part of its established QA program, the laboratory is required to take part in regularly scheduled Performance Evaluations and laboratory audits from State and Federal agencies for applicable tests. Each laboratory selected to support this program must maintain current NJDEP or Federal certifications, as appropriate.

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Laboratory Corrective Actions

If a particular laboratory analysis is deemed “out of control,” corrective action will be taken by the laboratory to maintain continued data quality. Each laboratory must adhere to their in-house corrective action policy. The coordinator of the laboratory’s analytical section will be responsible for initiating laboratory corrective action when necessary.

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QAPP Worksheet #33 (UFP QAPP Manual Section 4.2) -- QA Management Reports Table

Identify the frequency and type of planned QA Management Reports, the project delivery dates, the personnel responsible for report preparation, and the report recipients.

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Progress Reports	Monthly	Two weeks after the end of each month	Malcolm Pirnie PM or Task Leader	USEPA and USACE-KC PMs
TSA	Initially within the few weeks of field work and with follow up audits if significant deficiencies are found	Month after field work begins	SQO or designee	PM(s)
Data Validation Report	After lab data are received	Within 45 days after receiving data	Data Validator	SQO and PM
Corrective Action Reports	When corrective action is required	When corrective action is implemented	PM or designee	Project Team and PM(s)

The USACE-KC PM and USEPA PM will receive several types of management reports. These will include the results of any corrective action reports and data validation reports. In addition, the progress report will contain a section on quality control reports. Problems or issues that arise between regular reporting periods may be identified to program management at any time. Information included in the progress report will include the following:

- Results of TSA audits conducted during the period.
- An assessment of any problems with the measurement data, including accuracy, precision, completeness, representativeness, and comparability.
- A listing of the non-conformance reports including Stop-Work Orders issued during the period, related corrective actions undertaken, and an assessment of the results of these actions.
- Identification of significant quality assurance problems and recommended solutions, as necessary.

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QAPP Worksheet #34 (UFP-QAPP Manual Section 5.2.1) -- Verification (Step I) Process Table

Describe the processes that will be followed to verify project data. Describe how each item will be verified, when the activity will occur, and what documentation is necessary, and identify the person responsible. *Internal* or *external* is in relation to the data generator.

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Field entries	The Field Team Leader or designee will review entries for errors or omissions.	I	Malcolm Pirnie, Inc.
COC	Form will be internally reviewed upon completion and verified against field logs and laboratory reports. Review will occur with the completion of each report	I	Malcolm Pirnie, Inc.
Laboratory data packages	Laboratory data packages will be used to verify the report results in the project report and against QAPP criteria	I	Malcolm Pirnie, Inc.

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QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) -- Validation (Steps IIa and IIb) Process Table

Describe the processes that will be followed to validate project data. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be validated, when the activity will occur, and what documentation is necessary and identify the person responsible. Differentiate between steps IIa and IIb of validation.

Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Methods	Records support implementation of the SOPs in QAPP.	Malcolm Pirnie, Inc.
IIa	COC	Examine traceability of data from sample collection to generation of project report	Malcolm Pirnie, Inc.
IIb	Deviations from SOP and project documents.	Determine impacts of any deviation from method and the project plan.	Project Team led by the PM and DPM or their designees

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QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) -- Validation (Steps IIa and IIb) Summary Table

Identify the matrices, analytical groups, and concentration levels that each entity performing validation will be responsible for, as well as criteria that will be used to validate those data.

Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)¹
IIa	Sediment, filters and water	All chemistry parameters	NA	Against the criteria in the QAPP and the test methods	The laboratory and Malcolm Pirnie Inc

Commercial Subcontractor Laboratory Data

The commercial subcontractor laboratory data will be validated by Malcolm Pirnie or a qualified subcontractor against the QAPP and method criteria.

The Malcolm Pirnie data validator will also conduct a validation review of the first SDG received for each analytical parameter. This means that the validator will review the raw data and log book sheets, and will recalculate at least 10 percent of the sample and QC sample results. If this validation indicates that the laboratory is producing usable data, and when calculation and transcription errors are not being detected, the validation reviews may be scaled back and subsequent data packages will have a less rigorous review. The validation of all the chemistry data will then be based on the reviewed data packages and EDD files provided by the laboratory. The less rigorous validation would include a review of the raw data, but would not include calculation checks and a check for transcription errors.

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Once data validation is completed, a data validation report will be generated. The report will contain information regarding the parameters that are qualified, the reason for the qualification, and the direction of the bias (only for parameters qualified as estimated), when possible. Based upon the quality assurance review of the analytical data, specific codes (data qualifiers or 'flags') will be placed next to results to provide an indication of the quantitative and qualitative reliability of the results. The data qualifier codes in the USEPA CLP National Functional Guidelines for Organic and Inorganic Data Review are proposed for this project. Qualifiers assigned by laboratories will be defined by each laboratory in their data package and will be superseded by the data validator's qualifiers.

Any confirmatory radiochemistry data received from Dr. Bopp's laboratory at Rensselaer Polytechnic Institute and the Grain size data will not require data validation.

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QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) -- Usability Assessment

Describe the procedures / methods / activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Describe how data quality issues will be addressed and how limitations on the use of the data will be handled.

Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

The Malcolm Pirnie data validator or a qualified subcontractor will validate the non-CLP chemical data in accordance with the protocols outlined on Worksheet 36. The SQO, in conjunction with the PM, will determine whether the analytical data or data sets meet the requirements necessary for decision-making. The results of the measurements will be compared to the DQOs set forth in Attachment 1.1 and 1.2 of the QAPP.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

As part of the data validation process, the validator identifies any qualifications, the bias, if known, of the data, applies qualifiers and comments on the usability of the data. Once the validation package is received from the validator it is reviewed by the Site Quality Officer or a designee. Any QA/QC problems with the validation will be discussed with the validator and or the laboratory. As data are evaluated, anomalies in the data or data gaps may become apparent to the data users. Data that do not meet the DQOs will be identified and appropriately noted in the project database so data users are aware of any limitations or concerns with the usability of the data. If systematic problems with the laboratory data are encountered, the SQO will review the data to determine whether problems are field or laboratory-related. The laboratory will be contacted for their analysis of the situation, along with recommendations to correct the problem. Statistical tests such as means significance difference between the existing data used in the EMBM and the recently collected data will be performed to see whether the mean concentration between the two data group are the same or different. The criteria to see how the recently collected data will affect the empirical mass balance will vary for each contaminant modeled. Therefore, after performing the statistical tests, the empirical mass balance will be re-run for contaminants that are statistically significant to assess whether the empirical mass balance will be updated or accepted.

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Identify the personnel responsible for performing the usability assessment:

The usability of the data is the responsibility of the project team. The PM will assign technical staff to conduct the statistical data evaluation required to refine the EMBM after the data has been validated and reviewed.

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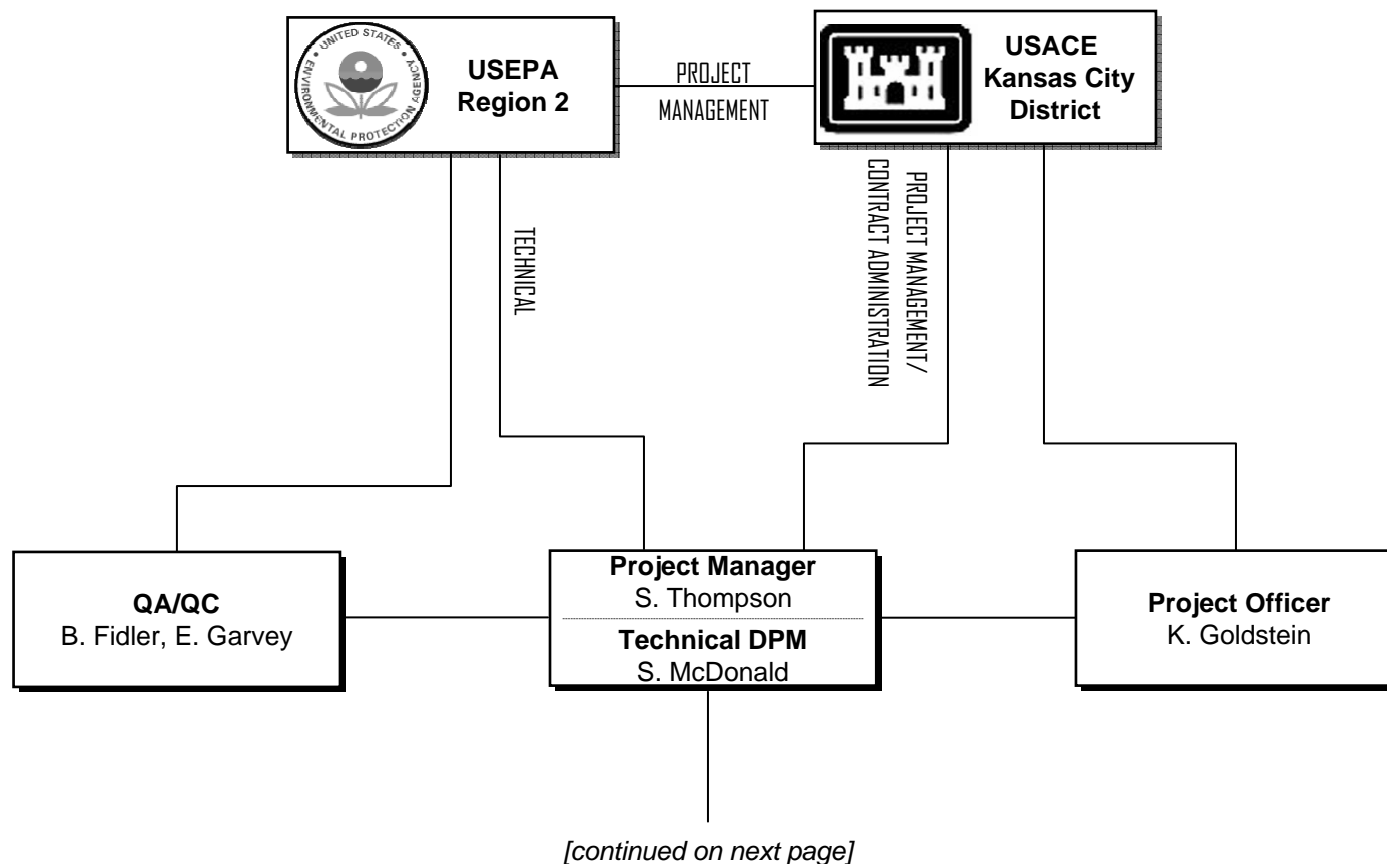
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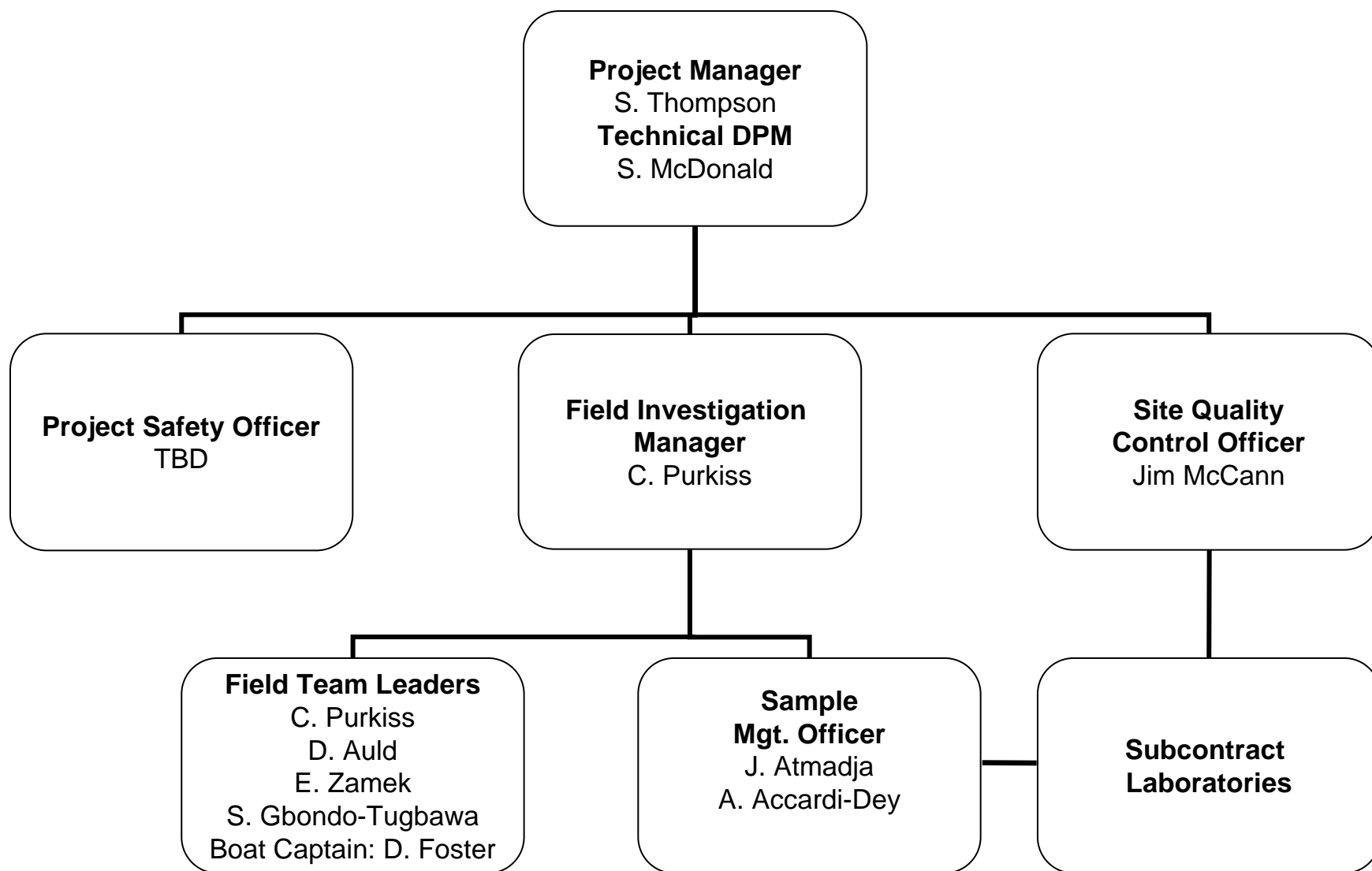
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Figures

Figure 1
Organization Chart



Lines of Communication between USEPA, USACE, and Malcolm Pirnie



Lines of Communication between Malcolm Pirnie team members and the subcontractor team members

ATTACHMENTS

Attachment 1.1

Data Quality Objectives – Characterizing External Loads

Attachment 1.1: Data Quality Objectives (DQO) for Characterizing the External Loads to the Lower Passaic River
QAPP Amendment (version November 29, 2007)

STEP 1 State the Problem	STEP 2 Identify the Goals of the Study	STEP 3 Identify the Information Inputs	STEP 4 Define the Boundaries of the Study	STEP 5 Develop the Analytical Approach	STEP 6 Specify Performance or Acceptance Criteria	STEP 7 Describe the Plan for Obtaining the Data
<p>Problem: The sediments of the Lower Passaic River have been and continue to be contaminated by external sources to the river. Data collected to date describe the current levels of contamination reaching the river, but further data are desired to better refine the estimates of external loads to the river.</p> <p>Planning Team: U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), New Jersey Department of Transportation (NJDOT), New Jersey Department of Environmental Protection (NJDEP), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), local workgroups, and other stakeholders.</p> <p>Primary Decision Maker: USEPA, USACE, NJDOT, NJDEP, NOAA, and USFWS.</p> <p>Conceptual Site Model: (Refer to Appendix A of the Focused Feasibility Study “Conceptual Site Model” Malcolm Pirnie, Inc. 2007.) The Lower Passaic River is a 17.4-mile estuarine river located in northern New Jersey. The river receives freshwater flow and solids from the Upper Passaic River (over the Dundee Dam), three major tributaries (Saddle River, Second River, and Third River), and discharge from combined sewer overflow (CSO) / stormwater outfall (SWO) sites. Salt water intrusion from Newark Bay impacts the river twice daily, causing surface sediment to resuspend and re-deposit daily as the salt front travels several miles</p>	<p>Principal Study Questions: (These principal study questions continue on Attachment 1.2 of the DQOs.)</p> <ul style="list-style-type: none">What are typical levels of suspended matter in the discharges from the tributaries (Saddle River, Second River, and Third River) and the Upper Passaic River?What are the current chemical characteristics of suspended matter in the tributaries (Saddle River, Second River, and Third River) and the Upper Passaic River?What are typical levels of suspended matter in the discharges from the CSO/SWO sites?What are the current chemical characteristics of suspended matter at the CSO/SWO discharge sites on the Lower Passaic River? <p>Program Goals: Supplement the dataset used for the conceptual site model and the empirical mass balance developed by Malcolm Pirnie, Inc. (February 2007 and June 2007, respectively). Specifically collect field data to further characterize:</p> <ul style="list-style-type: none">The chemical characteristics of recent (2005-2007) and very recent (fall 2007) suspended matter in the tributaries and the Upper Passaic River.The chemical characteristics of recent suspended matter at CSO/SWO discharge sites. <p>Alternative Actions: The following alternative actions could result from resolution of the principal study questions:</p> <ul style="list-style-type: none">Confirm or revise the conceptual site model and the	<p>Information Required: Information necessary to answer the decision statements will include the existing field data and data to be obtained from the planned sampling events (see Step 5 of the Data Quality Objective).</p> <p>New Data Needed: Refer to Step 5 of the Data Quality Objective for more information.</p> <ul style="list-style-type: none">Suspended matter concentrations in the tributaries, Upper Passaic River, and at CSO/SWO sites.Contaminant concentrations on the suspended matter from the tributaries, Upper Passaic River, and at CSO/SWO sites.Recently-deposited surface sediments in the tributaries and Upper Passaic River. <p>Existing Field Data (To Be Augmented):</p> <ul style="list-style-type: none">2007 USEPA Sediment Coring Program in Dundee Lake.2005 USEPA High Resolution Sediment Coring Program in the Lower Passaic River.2005 USEPA Large Volume Water Column Program in the Lower Passaic River.2005 USGS Water Monitoring Program in the Lower Passaic River (collected during the NJDOT Environmental Dredging Pilot Study).2005 USEPA SPMD Deployments in the Tributaries and the Lower Passaic River.2005 USEPA Small Volume Water Column Program in the Tributaries and the Lower Passaic River.2005 Tierra Solutions, Inc. Remedial Investigation Phase 1 Program in Newark Bay.2001-2004 CARP dataset on CSO/SWOs.1995 Tierra Solutions, Inc.	<p>Geographic Area: The Study Area comprises the Lower Passaic River proper and its riparian area (excluding the floodplain) from the Dundee Dam (RM17.4) in the north to the river confluence with Newark Bay (RM0) in the south. The Study Area also includes the major tributaries (Saddle River, Second River, and Third River), and the area drained by the CSO/SWO systems.</p> <p>Time Frame: Data collection will occur over a two-month period between November 2007 and January 2008. The sampling program will include up to six events (suspended matter samples only), including up to three rainfall events.</p> <p>Sample Type: Sampling will include water column suspended matter and recently-deposited surface sediments (0-1 inch sediment depth).</p>	<p>Approach for Collecting Suspended Matter: Employ large volume water column techniques (described in the Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.6).</p> <p>Chemical and Radiological Parameters and Anticipated Analytical Methods for Suspended Matter Samples: Polychlorinated biphenyls (PCB) congeners, pesticides, polychlorodibenzodioxin/furan (PCDD/F), polycyclic aromatic hydrocarbons (PAH), and TAL metals plus titanium and mercury. Other parameters include: total suspended solids (TSS) and particulate organic carbon (POC) during water column sampling.</p> <p>Approach for Collecting Surface Sediment: Short coring device, piston corer, or Ekman dredge following Standard Operating Procedure (SOP). Samples should represent a sediment depth of 0-1 inch and have sufficient mass to analyze for the suite of parameters.</p> <p>Chemical and Radiological Parameters and Anticipated Analytical Methods for Surface Sediment Samples: Radiochemistry (beryllium-7, cesium-137, and potassium -40), Polychlorinated biphenyls (PCB) congeners, pesticides, polychlorodibenzodioxin/furan (PCDD/F), polycyclic aromatic hydrocarbons (PAH), and TAL metals plus titanium and mercury. Other parameters include: total organic carbon (TOC) and grain size for sediment sampling.</p> <p>Project Quantification Limits: The action levels will be similar to</p>	<p>Potential Source of Error in Data <u>Sampling Error</u></p> <ul style="list-style-type: none">Ability to identify recently-deposited surface sediments in the tributaries and Upper Passaic River. Measurements identifying the presence of beryllium-7 will be used to confirm the locations as containing recently-deposited sediments.Individual large volume water column samples represent a “snap-shot” of TSS properties in time (not an integrated sample). A collection of several large volume samples at each location and the collection of beryllium-7 bearing sediments will provide a measure of the variability and mean of contaminant concentrations.Local influences may modify properties of recently-deposited sediments in the immediate vicinity of the release point. Several points will be identified and analyzed, thereby minimizing the impact of a single erroneous sample. Sample results will also be compared to existing data for consistency. Locations near outfalls will be avoided and several locations will be analyzed to minimize this concern. <p><u>Measurement Error</u> To control measurement error, a QA/QC program will be implemented (refer to Step 5 of the Data Quality Objective).</p> <p><u>Decision Error</u> The data will be used to augment existing field data and update the empirical mass balance. Results from the model will be used to</p>	<p>Suspended Matter Sampling on Tributaries:</p> <ul style="list-style-type: none">Four (4) sampling locations: above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or at the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Locations will generally correspond to the 2005 sampling locations for the SPMD deployments (described in the Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.6).At each location, collect one (1) suspended matter sample using the similar large volume water column technique tested by Malcolm Pirnie, Inc. in 2005 (described in the Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.2).Samples will be analyzed for TSS, POC, PCB congeners, PCDD/F, PAH, pesticides, and TAL metals plus titanium and mercury.Data evaluations will be performed on the analytes listed in Table 4-3 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007. <p>Recently-Deposited Surface Sediment Sampling on Tributaries:</p> <ul style="list-style-type: none">Four (4) primary sampling locations: above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or upriver of the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Locations will be within the vicinity of the 2005 sampling locations for the

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<p>between river mile (RM) 0 and RM15.</p> <p>Channel construction prior to the 1950s created a deep channel along the length of the river (elevation of -10 to -30 feet relative to mean low water). Subsequent neglect of the channel has resulted in a thick accumulation of contaminated solids (approximately 10 to 15 feet thick) throughout much of the lower 8 miles of the river. The main external sources of solids to the river are the Upper Passaic River, tributaries, CSO/SWO, and Newark Bay. Internal reworking of the river bottom (via resuspension) by tidal current also affects river bottom contamination.</p> <p>Urban and industrial development around the river has resulted in poor water quality, contaminated sediments, bans on fish and shellfish consumption, loss of wetlands, and degraded habitat.</p> <p>Identifying Deadlines and Constraints:</p> <ul style="list-style-type: none">• New data need to be collected and evaluated.• The empirical mass balance should be reviewed and updated to reflect the new information prior to the final version of the Focused Feasibility Study.• Program needs to be completed in six (6) months (June 2008).	<p>associated empirical mass balance calculations; reconciling the most recent observations with those made during prior studies.</p> <ul style="list-style-type: none">• Provide further support to the alternatives identified in the Draft Source Control Early Action Focused Feasibility Study (June 2007) or provide a basis to modify the alternatives.• Provide a basis to address additional external sources to the Lower Passaic River, if identified. <p>Decision Statements on Suspended Matter and Surface Sediment in Tributaries and Upper Passaic River:</p> <ul style="list-style-type: none">• If the contaminant concentrations on suspended matter and in recently-deposited surface sediments measured in the tributaries are similar to those concentrations used in preparing the empirical mass balance (Table 4-18 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007), then the tributary source is well characterized in the model. If not, the new data will be combined with existing data to characterize the tributary source and the model will be updated accordingly.• If the contaminant concentrations on suspended matter and in recently-deposited surface sediments measured in the Upper Passaic River are similar to those concentrations reported in empirical mass balance (Table 4-13 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007), then the Upper Passaic River source is well characterized in the model. If	<p>Remedial Investigation data for the Lower Passaic River.</p> <p>Supplemental Field Data</p> <ul style="list-style-type: none">• 2005 USEPA Beryllium-7 Field Reconnaissance in the Lower Passaic River.• 2005 USEPA Sediment Texture Maps (as interpreted by Aqua Survey, Inc. side-scan sonar) of the Lower Passaic River.• Historical bathymetric surveys from 2004, 2001, 1999, 1997, 1996, 1995, and 1989.• Data collected during the anticipated 2007-2008 field program to characterize resuspension of fine-grained sediments (refer to Attachment of the DQOs). <p>Existing Reports:</p> <ul style="list-style-type: none">• Malcolm Pirnie, Inc. 2007 “Draft Source Control Early Action: Focused Feasibility Study.”• Malcolm Pirnie, Inc. 2007 “Conceptual Site Model.”• Malcolm Pirnie, Inc. 2006 “Draft Geochemical Evaluation (Step 2)”		<p>the Reporting Limits in the Lower Passaic River Quality Assurance Project Plan (QAPP) of August 2005 and associated amendments.</p> <p>Quality Assurance/Quality Control Program (QA/QC):</p> <p><u>QA/QC samples will be analyzed with the samples appropriate to each analytical test such as field duplicates, laboratory duplicates, samples spokes, surrogates and rinsate blanks.</u></p> <p>Anticipated Data Evaluations:</p> <ul style="list-style-type: none">• Comparison of the analyte patterns (fingerprinting) in suspended matter and surface sediment.• Comparison of analyte ratios between existing data and new data.• Multivariate evaluation of data (including principal component analysis and cluster analysis).• Revisions of the empirical mass balance calculations to reflect any refinement of the contaminant concentrations in the external sources examined.	<p>guide the decision making process on the final version of the Focused Feasibility Study. Decision error will ultimately be minimized through a weight-of-evidence approach, which incorporates all the pertinent information.</p> <p>Additional Uncertainties:</p> <ul style="list-style-type: none">• Access to CSO/SWO sites.• Identification of and accessibility to sampling locations on the tributaries and Upper Passaic River.• Vessel for sampling.• Field facility for processing samples.	<p>SPMD deployments (described in the Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007 – Section 4.1.6).</p> <ul style="list-style-type: none">• One (1) sampling event.• At each primary location, collect six (6) surface sediment samples using either a short-coring device, piston core, or an Ekman dredge. Samples should represent sediment depth of 0-1 inch and have sufficient mass to analyze for the suite of parameters. The six samples should be distributed around the primary sampling location so as to maximize the probability of obtaining beryllium-7 bearing sediment. The samples should not be obtained in close proximity.• Each sample will be analyzed for beryllium-7, cesium-137, potassium-40, TOC, grain size, and TAL metals plus titanium and mercury. Eight samples (two samples per tributary) that have detectable quantities of beryllium-7 that represent a depositional environment will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides.• Data evaluations will be performed on the analytes listed in Table 4-3 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007. <p>“High Flow” Suspended Matter Sampling in CSO and SWO:</p> <p>CSO “Regulator” Overflow Large Water Column Sampling:</p> <ul style="list-style-type: none">• There will be 4 rainfall sampling events, if possible.• At each location, collect large volume water samples.• Each sample will be analyzed for POC, grain size, PCB congener, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The laboratories will perform the filtration of the water samples.
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	<p>not, the new data will be combined with existing data to characterize the Upper Passaic River source and the model will be updated accordingly.</p> <p>Decision Statements on Suspended Matter and Solids in CSO/SWO:</p> <ul style="list-style-type: none">• If the contaminant concentration on suspended matter and solids measured at the CSO/SWO sites are similar to those concentrations used in preparing the empirical mass balance (Table 4-19 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007), then the CSO/SWO source is well characterized in the model. If not, the new data will be used to characterize the CSO/SWO source and the model will be updated accordingly.					<p>SWO Sampling:</p> <ul style="list-style-type: none">• There will be 4 rainfall sampling events, if possible• At each location, collect large volume water samples.• Each sample will be analyzed for POC, grain size, PCBs, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The laboratories will perform the filtration of the water samples.
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Attachment 1.2

Data Quality Objectives – Characterizing the Resuspension of Fine-Grained Sediments

Attachment 1.2: Data Quality Objectives for Characterizing the Resuspension of Fine-Grained Sediments (Internal Loads) in the Lower Passaic River
QAPP Amendment (version November 14, 2007)

STEP 1 State the Problem	STEP 2 Identify the Goals of the Study	STEP 3 Identify the Information Inputs	STEP 4 Define the Boundaries of the Study	STEP 5 Develop the Analytical Approach	STEP 6 Specify Performance or Acceptance Criteria	STEP 7 Describe the Plan for Obtaining the Data
<p>Problem: The sediments of the Lower Passaic River have been (and may continue to be) contaminated by external sources to the river. Data collected to date describe the current levels of contamination reaching the river, but further data are desired to better refine the estimates of external loads to the river.</p> <p>Planning Team: U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), New Jersey Department of Transportation (NJDOT), New Jersey Department of Environmental Protection (NJDEP), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), local workgroups, and other stakeholders.</p> <p>Primary Decision Maker: USEPA, USACE, NJDOT, NJDEP, NOAA, and USFWS.</p> <p>Conceptual Site Model: (Refer to Appendix A of the Focused Feasibility Study “Conceptual Site Model” Malcolm Pirnie, Inc. 2007.) The Lower Passaic River is a 17.4-mile estuarine river located in northern New Jersey. The river receives freshwater flow and solids from the Upper Passaic River (over the Dundee Dam), three major tributaries (Saddle River, Second River, and Third River), and discharge from combined sewer overflow (CSO) / stormwater outfall (SWO) sites. Salt water intrusion from Newark Bay impacts the river twice daily, causing surface sediment to resuspend and re-deposit daily as the salt front travels several miles</p>	<p>Principal Study Questions: (These principal study objectives build on the study questions presented in Attachment 1.1 of the DQOs.)</p> <ul style="list-style-type: none">How do recently-deposited surface sediment concentrations in the Lower Passaic River compare with observations of surface sediments from 1995 and 2005?What are the contaminant inventories in fine-grained sediments above RM8?What are surface contaminant concentrations in fine-grained sediments above RM8? (The top 6 inches of sediment is preliminarily considered the most likely depth to erode in a high-flow event.) <p>Program Goals: Supplement the dataset used for the conceptual site model and the empirical mass balance developed by Malcolm Pirnie, Inc. (February 2007 and June 2007, respectively). Specifically collect field data to further characterize:</p> <ul style="list-style-type: none">The recently-deposited surface sediments (0-1 inch) in the Lower Passaic River (RM 0-17).Fine grained surface sediments (0-6 inches) above RM8.Fine grained sediment inventories above RM8. <p>Alternative Actions: The following alternative actions could result from resolution of the principal study questions:</p> <ul style="list-style-type: none">Confirmation or revision of the conceptual site model and the associated empirical mass balance calculations; reconciling the most recent observations with those made	<p>Information Required: Information necessary to answer the decision statements will include the existing field data and data to be obtained from the planned sampling events (see Step 5 of the Data Quality Objective).</p> <p>New Data Needed: Refer to Step 5 of the Data Quality Objective for more information.</p> <ul style="list-style-type: none">Recently-deposited surface sediment (0-1 inch) in the Lower Passaic River.Contaminant concentrations in surface sediment (0-6 inches) above RM8.Contaminant sediment inventories via coring in fine grained sediment areas above RM8. <p>Existing Field Data (To Be Augmented):</p> <ul style="list-style-type: none">2007 USEPA Sediment Coring Program in Dundee Lake.2005 USEPA High Resolution Sediment Coring Program in the Lower Passaic River.2005 USEPA Large Volume Water Column Program in the Lower Passaic River.2005 USGS Water Monitoring Program in the Lower Passaic River (collected during the NJDOT Environmental Dredging Pilot Study).2005 USEPA SPMD Deployments in the Tributaries and the Lower Passaic River.2005 USEPA Small Volume Water Column Program in the Tributaries and the Lower Passaic River.2005 Tierra Solutions, Inc. Remedial Investigation Phase 1 Program in Newark Bay.2001-2004 CARP dataset on CSO/SWOs.1995 Tierra Solutions, Inc. Remedial Investigation data	<p>Geographic Area: The Study Area comprises the Lower Passaic River proper and its riparian area (excluding the floodplain) from the Dundee Dam (RM17.4) in the north to the river confluence with Newark Bay (RM0) in the south. The Study Area also includes the major tributaries (Saddle River, Second River, and Third River).</p> <p>Time Frame: Data collection will occur over a two-month period between November 2007 and January 2008.</p> <p>Sample Type: Sampling will include recently-deposited surface sediments (0-1 inch sediment depth), surface sediments (0-6 inches), and deep sediments (6 inches to refusal by a hand held coring device).</p>	<p>Approach for Collecting 0 to 1 inch Surface Sediments: Employ shallow coring device, Ekman dredge, or piston-coring device following Standard Operating Procedure (SOP).</p> <p>Chemical and Radiological Parameters and Anticipated Analytical Methods for 0 to 1 inch Surface Sediment Samples: Radiochemistry (beryllium-7, cesium-137, and potassium -40), Polychlorinated biphenyls (PCB) congeners, pesticides, polychlorodibenzodioxin/furan (PCDD/F), polycyclic aromatic hydrocarbons (PAH), and TAL metals plus titanium and mercury. Other parameters include: total organic carbon (TOC) and grain size.</p> <p>Approach Collecting Fine Grained Sediment Cores above RM8: Employ hand-held coring device designed to obtain up to 4 ft, or more, of sediment (<i>e.g.</i>, piston-coring device) following Standard Operating Procedure (SOP)</p> <p>Chemical and Radiological Parameters and Anticipated Analytical Methods for Fine Grain Sediment Cores above RM8: Radiochemistry (cesium-137, and potassium -40), PCB Aroclors, pesticides, polychlorodibenzodioxin/furan (PCDD/F), polycyclic aromatic hydrocarbons (PAH), and TAL metals plus titanium and mercury. Other parameters include: total organic carbon (TOC) and grain size.</p> <p>Project Quantification Limits: The action levels will be similar to the Reporting Limits in the Lower Passaic River Quality Assurance Project Plan (QAPP) of August 2005 and associated amendments.</p>	<p>Potential Source of Error in Data Sampling Error</p> <ul style="list-style-type: none">Ability to identify recently-deposited surface sediments in Lower Passaic River. Measurements identifying the presence of beryllium-7 will be used to confirm the locations as containing recently-deposited sediments.Local influences may modify properties of recently-deposited sediments in the immediate vicinity of the release point. Several points will be identified and analyzed, thereby minimizing the impact of a single erroneous sample. Sample results will also be compared to existing data for consistency. Locations near outfalls will be avoided and several locations will be analyzed to minimize this concern. <p>Measurement Error To control measurement error, a QA/QC program will be implemented (refer to Step 5 of the Data Quality Objective).</p> <p>Decision Error The data will be used to augment existing field data and update the empirical mass balance. Results from the model will be used to guide the decision making process on the final version of the Focused Feasibility Study. Decision error will ultimately be minimized through a weight-of-evidence approach, which incorporates all the pertinent information.</p> <p>Additional Uncertainties:</p> <ul style="list-style-type: none">Identification of and accessibility to sampling locations.Vessel for sampling.Field facility for processing	<p>Recently-Deposited Surface Sediment Sampling in the Lower Passaic River:</p> <ul style="list-style-type: none">Twenty (20) sampling locations will be occupied, some guided by the 2005 beryllium-7 field reconnaissance sites with detectable levels of beryllium-7 (refer to Attachment 4 of the December 23, 2005 Malcolm Pirnie, Inc. technical memorandum). Locations will extend over the full length of the Lower Passaic River from RM0 to RM17.4.One (1) sampling event.At each location, collect one (1) surface sediment sample using either a short-coring device, Ekman dredge, or piston-coring device. Samples should represent sediment depth of 0-1 inch and have sufficient mass to analyze for a suite of analytes.Each sample will be analyzed for beryllium-7, cesium-137, potassium-40, TOC, grain size, and TAL metals plus titanium and mercury. Samples that have detectable quantities of beryllium-7, indicating a depositional environment, will be analyzed for PCB congeners, PCDD/F, PAH, and pesticides.Data evaluations will be performed on the analytes listed in Table 4-3 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007. <p>Fine Grained Sediment Sampling in the Lower Passaic River above RM8:</p> <ul style="list-style-type: none">Twenty (20) sampling locations above RM8. Three (3) locations will correspond

Attachment 1.2: Data Quality Objectives for Characterizing the Resuspension of Fine-Grained Sediments (Internal Loads) in the Lower Passaic River
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<p>between river mile (RM) 0 and RM15.</p> <p>Channel construction prior to the 1950s created a deep channel along the length of the river (elevation of -10 to -30 feet relative to mean low water). Subsequent neglect of the channel has resulted in an accumulation of contaminated solids (approximately 10 to 15 feet thick) throughout much of the lower 8 miles of the river. The main external sources of solids to the river are the Upper Passaic River, tributaries, CSO/SWO, and Newark Bay. Internal reworking of the river bottom (via resuspension) by tidal current also affects river bottom contamination.</p> <p>Urban and industrial development around the river has resulted in poor water quality, contaminated sediments, bans on fish and shellfish consumption, loss of wetlands, and degraded habitat.</p> <p>Identifying Deadlines and Constraints:</p> <ul style="list-style-type: none">• New data need to be collected and evaluated.• The empirical mass balance should be reviewed and updated to reflect the new information prior to the final version of the Focused Feasibility Study.• Program needs to be completed in six (6) months (June 2008).	<p>during prior studies.</p> <ul style="list-style-type: none">• Provide further support to the alternatives identified in the Draft Source Control Early Action Focused Feasibility Study (June 2007) or provide a basis to modify the alternatives. <p>Decision Statements on Surface Sediment in the Lower Passaic River:</p> <ul style="list-style-type: none">• If surface sediment concentrations of the contaminants are consistent with the observations made in 1995 (Tierra Solutions, Inc. remedial investigation program) and 2005 (USEPA high resolution core program), then the new data provide further confirmation of the conceptual site model for the Lower Passaic River. If not, then the new data must be reconciled with the prior observations and the conceptual site model should be modified to reflect all of the information.• If sediment inventories are large above RM 8 relative to lower river inventories, then the FFS needs to consider their importance to a successful remedial action. If not, then the FFS can continue to focus on the lower 8 miles, as previously done.	<p>for the Lower Passaic River.</p> <p>Supplemental Field Data</p> <ul style="list-style-type: none">• 2005 USEPA Beryllium-7 Field Reconnaissance in the Lower Passaic River.• 2005 USEPA Sediment Texture Maps (as interpreted by Aqua Survey, Inc. side-scan sonar) of the Lower Passaic River.• Historical bathymetric surveys from 2004, 2001, 1999, 1997, 1996, 1995, and 1989.• Data collected during the anticipated 2007-2008 field program to characterize external sources (refer to Attachment 1.1 of the DQOs). <p>Existing Reports:</p> <ul style="list-style-type: none">• Malcolm Pirnie, Inc. 2007 “Draft Source Control Early Action: Focused Feasibility Study.”• Malcolm Pirnie, Inc. 2007 “Conceptual Site Model.”• Malcolm Pirnie, Inc. 2006 “Draft Geochemical Evaluation (Step 2)”		<p>Quality Assurance/Quality Control Program (QA/QC): QA/QC samples will be analyzed with the sediment samples appropriate for each analytical test such as field duplicates, laboratory Duplicates, sample spikes, surrogates and rinsate blanks.</p> <p>Anticipated Data Evaluations:</p> <ul style="list-style-type: none">• Comparison of the analyte patterns (fingerprinting) in surface sediment.• Comparison of analyte ratios between existing data and new data.• Multivariate evaluation of data (including principal component analysis and cluster analysis).• Revisions of the empirical mass balance calculations to reflect any refinement of the contaminant concentrations in the external sources examined.• Estimation of contaminant inventory above RM 8 (0-6 in and entire depositional thickness).	<p>samples.</p>	<p>to the existing Sedflume locations.</p> <ul style="list-style-type: none">• One (1) sampling event.• At each location, collect one (1) sediment core using a hand held coring device such as a piston-corer. Each sediment core will be divided into two (2) sediment samples, representing 0-6 inches and 6 inches to refusal (or until the dark reddish brown silty sand background material is encountered).• Each sample will be analyzed for beryllium-7, cesium-137, potassium-40, TOC, grain size, TAL metals plus titanium and mercury., PCB Aroclors, PCDD/F, PAH, and pesticides.• Data evaluations will be performed on the analytes listed in Table 4-3 in Appendix D of the Focused Feasibility Study “Empirical Mass Balance Model” Malcolm Pirnie, Inc. 2007.
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Attachment 2.1

PCB Congener Method Detection Limits

Attachment 2.1

Method Detection Limits Matrix: Solid Polychlorinated Biphenyls (PCB) Laboratory: Axys Analytical		
PCB Congeners IUPC Number	CAS Number	Analytical Method - as per USEPA 1668A on 10 g sample
		MDLs (pg/g)
1	2051-60-7	0.18
2	2051-61-8	0.19
3	2051-62-9	0.19
4	13029-08-8	0.47
5	16605-91-7	0.12
6	25569-80-6	0.19
7	33284-50-3	0.30
8	34883-43-7	0.74
9	34883-39-1	0.16
10	33146-45-1	0.19
11	2050-67-1	0.56
12	2974-92-7	0.25
13	2974-90-5	0.25
14	34883-41-5	0.19
15	2050-68-2	0.37
16	38444-78-9	0.36
17	37680-66-3	0.38
18	37680-65-2	0.67
19	38444-73-4	0.18
20	38444-84-7	0.94
21	55702-46-0	0.50
22	38444-85-8	0.35
23	55720-44-0	0.14
24	55702-45-9	0.13
25	55712-37-3	0.17
26	38444-81-4	0.24
27	38444-76-7	0.15
28	7012-37-5	0.94
29	15862-07-4	0.24
30	35693-92-6	0.67
31	16606-02-3	0.82
32	38444-77-8	0.27
33	38444-86-9	0.50
34	37680-68-5	0.11
35	37680-69-6	0.16
36	38444-87-0	0.13
37	38444-90-5	0.23
38	53555-66-1	0.23
39	38444-88-1	0.21
40	38444-93-8	0.49
41	52663-59-9	0.49
42	36559-22-5	0.19
43	70362-46-8	0.87
44	41464-39-5	0.57
45	70362-45-7	0.57
46	41464-47-5	0.13

Attachment 2.1

Method Detection Limits Matrix: Solid Polychlorinated Biphenyls (PCB) Laboratory: Axy's Analytical		
PCB Congeners IUPC Number	CAS Number	Analytical Method - as per USEPA 1668A on 10 g sample
		MDLs (pg/g)
47	2437-79-8	0.57
48	70362-47-9	0.28
49	41464-40-8	0.41
50	62796-65-0	0.26
51	68194-04-7	0.57
52	35693-99-3	0.44
53	41464-41-9	0.26
54	15968-05-5	0.15
55	74338-24-2	0.32
56	41464-43-1	0.27
57	70424-67-8	0.31
58	41464-49-7	0.41
59	74472-33-6	0.36
60	33025-41-1	0.51
61	33284-53-6	1.1
62	54230-22-7	0.36
63	74472-34-7	0.26
64	52663-58-8	0.21
65	33284-54-7	0.57
66	32598-10-0	0.68
67	73575-53-8	0.24
68	73575-52-7	0.22
69	60233-24-1	0.41
70	32598-11-1	1.1
71	41464-46-4	0.49
72	41464-42-0	0.18
73	74338-23-1	0.20
74	32690-93-0	1.1
75	32598-12-2	0.36
76	70362-48-0	1.1
77	32598-13-3	0.21
78	70362-49-1	0.36
79	41464-48-6	0.42
80	33284-52-5	0.32
81	70362-50-4	0.27
82	52663-62-4	0.18
83	60145-20-2	0.60
84	52663-60-2	0.22
85	65510-45-4	0.40
86	55312-69-1	0.70
87	38380-02-8	0.70
88	55215-17-3	0.34
89	73575-57-2	0.12
90	68194-07-0	0.56
91	68194-05-8	0.34
92	52663-61-3	0.19

Attachment 2.1

Method Detection Limits Matrix: Solid Polychlorinated Biphenyls (PCB) Laboratory: Axys Analytical		
PCB Congeners IUPC Number	CAS Number	Analytical Method - as per USEPA 1668A on 10 g sample
		MDLs (pg/g)
93	73575-56-1	4.3
94	73575-55-0	0.21
95	38379-99-6	4.3
96	73575-54-9	0.14
97	41464-51-1	0.70
98	60233-25-2	4.3
99	38380-01-7	0.60
100	39485-83-1	4.3
101	37680-73-2	0.56
102	68194-06-9	4.3
103	60145-21-3	0.13
104	56558-16-8	0.13
105	32598-14-4	0.24
106	70424-69-0	0.21
107	70424-68-9	0.36
108	70362-41-3	0.70
109	74472-35-8	0.27
110	38380-03-9	0.48
111	39635-32-0	0.12
112	74472-36-9	0.22
113	68194-10-5	0.56
114	74472-37-0	0.19
115	74472-38-1	0.48
116	18259-05-7	0.40
117	68194-11-6	0.40
118	31508-00-6	0.48
119	56558-17-9	0.70
120	68194-12-7	0.20
121	56558-18-0	0.20
122	76842-07-4	0.26
123	65510-44-3	0.16
124	70424-70-3	0.36
125	74472-39-2	0.70
126	57465-28-8	0.29
127	39635-33-1	0.18
128	38380-07-3	0.81
129	55215-18-4	1.2
130	52663-66-8	0.18
131	61798-70-7	0.32
132	38380-05-1	0.31
133	35694-04-3	0.20
134	52704-70-8	0.46
135	52744-13-5	1.4
136	38411-22-2	0.42
137	35694-06-5	0.42
138	35065-28-2	1.2

Attachment 2.1

Method Detection Limits Matrix: Solid Polychlorinated Biphenyls (PCB) Laboratory: Axy's Analytical		
PCB Congeners IUPC Number	CAS Number	Analytical Method - as per USEPA 1668A on 10 g sample
		MDLs (pg/g)
139	56030-56-9	0.58
140	59291-64-4	0.58
141	52712-04-6	0.21
142	41411-61-4	0.36
143	68194-15-0	0.46
144	68194-14-9	0.29
145	74472-40-5	0.25
146	51908-16-8	0.37
147	68194-13-8	0.62
148	74472-41-6	0.31
149	38380-04-0	0.62
150	68194-08-1	0.25
151	52663-63-5	1.4
152	68194-09-2	0.31
153	35065-27-1	0.67
154	60145-22-4	1.4
155	33979-03-2	0.11
156	38380-08-4	0.16
157	69782-90-7	0.16
158	74472-42-7	0.26
159	39635-35-3	0.29
160	41411-62-5	1.2
161	74472-43-8	0.31
162	39635-34-2	0.30
163	74472-44-9	1.2
164	74472-45-0	0.20
165	74472-46-1	0.33
166	41411-63-6	0.81
167	52663-72-6	0.46
168	59291-65-5	0.67
169	32774-16-6	0.14
170	35065-30-6	0.17
171	52663-71-5	0.44
172	52663-74-8	0.22
173	68194-16-1	0.44
174	38411-25-5	0.16
175	40186-70-7	0.19
176	52663-65-7	0.13
177	52663-70-4	0.24
178	52663-67-9	0.12
179	52663-64-6	0.12
180	35065-29-3	0.19
181	74472-47-2	0.72
182	60145-23-5	0.12
183	52663-69-1	0.23
184	74472-48-3	0.15

Attachment 2.1

Method Detection Limits Matrix: Solid Polychlorinated Biphenyls (PCB) Laboratory: Axys Analytical		
PCB Congeners IUPC Number	CAS Number	Analytical Method - as per USEPA 1668A on 10 g sample
		MDLs (pg/g)
185	52712-05-7	0.23
186	74472-49-4	0.14
187	52663-68-0	0.10
188	74487-85-7	0.11
189	39635-31-9	0.07
190	41411-64-7	0.19
191	74472-50-7	0.08
192	74472-51-8	0.15
193	69782-91-8	0.19
194	35694-08-7	0.11
195	52663-78-2	0.13
196	42740-50-1	0.14
197	33091-17-7	0.21
198	68194-17-2	0.16
199	52663-75-9	0.16
200	52663-73-7	0.21
201	40186-71-8	0.13
202	2136-99-4	0.15
203	52663-76-0	0.14
204	74472-52-9	0.17
205	74472-53-0	0.12
206	40186-72-9	0.19
207	52663-79-3	0.27
208	52663-77-1	0.25
209	2051-24-3	0.24

1. Axys Analytical statistically determined method detection limits (MDLs)

pg/g = picogram per gram

Attachment 2.2

PCB Congener Co-Elution Table

Attachment 2.2
PCB Congener Co-Elution Table

PCB Congener	IUPAC NO.	CO-ELUTIONS	CAS Number
2 - MoCB	1		2051-60-7
3 - MoCB	2		2051-61-8
4 - MoCB	3		2051-62-9
2,2' - DiCB	4		13029-08-8
2,3 - DiCB	5		16605-91-7
2,3' - DiCB	6		25569-80-6
2,4 - DiCB	7		33284-50-3
2,4' - DiCB	8		34883-43-7
2,5 - DiCB	9		34883-39-1
2,6 - DiCB	10		33146-45-1
3,3' - DiCB	11		2050-67-1
3,4 - DiCB	12	12 + 13	2974-92-7
3,4' - DiCB	13	12 + 13	2974-90-5
3,5 - DiCB	14		34883-41-5
4,4' - DiCB	15		2050-68-2
2,2',3 - TriCB	16		38444-78-9
2,2',4 - TriCB	17		37680-66-3
2,2',5 - TriCB	18	18 + 30	37680-65-2
2,2',6 - TriCB	19		38444-73-4
2,3,3' - TriCB	20	20 + 28	38444-84-7
2,3,4 - TriCB	21	21 + 33	55702-46-0
2,3,4' - TriCB	22		38444-85-8
2,3,5 - TriCB	23		55720-44-0
2,3,6 - TriCB	24		55702-45-9
2,3',4 - TriCB	25		55712-37-3
2,3',5 - TriCB	26	26 + 29	38444-81-4
2,3',6 - TriCB	27		38444-76-7
2,4,4' - TriCB	28	20 + 28	7012-37-5
2,4,5 - TriCB	29	26 + 29	15862-07-4
2,4,6 - TriCB	30	18 + 30	35693-92-6
2,4',5 - TriCB	31		16606-02-3
2,4',6 - TriCB	32		38444-77-8
2',3,4 - TriCB	33	21 + 33	38444-86-9
2',3,5 - TriCB	34		37680-68-5
3,3',4 - TriCB	35		37680-69-6
3,3',5 - TriCB	36		38444-87-0
3,4,4' - TriCB	37		38444-90-5
3,4,5 - TriCB	38		53555-66-1
3,4',5 - TriCB	39		38444-88-1
2,2',3,3' - TeCB	40	40 + 41 + 71	38444-93-8
2,2',3,4 - TeCB	41	40 + 41 + 71	52663-59-9
2,2',3,4' - TeCB	42		36559-22-5
2,2',3,5 - TeCB	43		70362-46-8
2,2',3,5' - TeCB	44	44 + 47 + 65	41464-39-5
2,2',3,6 - TeCB	45	45 + 51	70362-45-7
2,2',3,6' - TeCB	46		41464-47-5
2,2',4,4' - TeCB	47	44 + 47 + 65	2437-79-8
2,2',4,5 - TeCB	48		70362-47-9
2,2',4,5' - TeCB	49	49 + 69	41464-40-8
2,2',4,6 - TeCB	50	50 + 53	62796-65-0

Attachment 2.2
PCB Congener Co-Elution Table

PCB Congener	IUPAC NO.	CO-ELUTIONS	CAS Number
2,2',4,6' - TeCB	51	45 + 51	68194-04-7
2,2',5,5' - TeCB	52		35693-99-3
2,2',5,6' - TeCB	53	50 + 53	41464-41-9
2,2',6,6' - TeCB	54		15968-05-5
2,3,3',4 - TeCB	55		74338-24-2
2,3,3',4' - TeCB	56		41464-43-1
2,3,3',5 - TeCB	57		70424-67-8
2,3,3',5' - TeCB	58		41464-49-7
2,3,3',6 - TeCB	59	59 + 62 + 75	74472-33-6
2,3,4,4' - TeCB	60		33025-41-1
2,3,4,5 - TeCB	61	61 + 70 + 74 + 76	33284-53-6
2,3,4,6 - TeCB	62	59 + 62 + 75	54230-22-7
2,3,4',5 - TeCB	63		74472-34-7
2,3,4',6 - TeCB	64		52663-58-8
2,3,5,6 - TeCB	65	44 + 47 + 65	33284-54-7
2,3',4,4' - TeCB	66		32598-10-0
2,3',4,5 - TeCB	67		73575-53-8
2,3',4,5' - TeCB	68		73575-52-7
2,3',4,6 - TeCB	69	49 + 69	60233-24-1
2,3',4',5 - TeCB	70	61 + 70 + 74 + 76	32598-11-1
2,3',4',6 - TeCB	71	40 + 41 + 71	41464-46-4
2,3',5,5' - TeCB	72		41464-42-0
2,3',5',6 - TeCB	73		74338-23-1
2,4,4',5 - TeCB	74	61 + 70 + 74 + 76	32690-93-0
2,4,4',6 - TeCB	75	59 + 62 + 75	32598-12-2
2',3,4,5 - TeCB	76	61 + 70 + 74 + 76	70362-48-0
3,3',4,4' - TeCB	77		32598-13-3
3,3',4,5 - TeCB	78		70362-49-1
3,3',4,5' - TeCB	79		41464-48-6
3,3',5,5' - TeCB	80		33284-52-5
3,4,4',5 - TeCB	81		70362-50-4
2,2',3,3',4 - PeCB	82		52663-62-4
2,2',3,3',5 - PeCB	83	83 + 99	60145-20-2
2,2',3,3',6 - PeCB	84		52663-60-2
2,2',3,4,4' - PeCB	85	85 + 116 + 117	65510-45-4
2,2',3,4,5 - PeCB	86	86 + 87 + 97 + 108 + 119 + 125	55312-69-1
2,2',3,4,5' - PeCB	87	86 + 87 + 97 + 108 + 119 + 125	38380-02-8
2,2',3,4,6 - PeCB	88	88 + 91	55215-17-3
2,2',3,4,6' - PeCB	89		73575-57-2
2,2',3,4',5 - PeCB	90	90 + 101 + 113	68194-07-0
2,2',3,4',6 - PeCB	91	88 + 91	68194-05-8
2,2',3,5,5' - PeCB	92		52663-61-3
2,2',3,5,6 - PeCB	93	93 + 95 + 98 + 100 + 102	73575-56-1
2,2',3,5,6' - PeCB	94		73575-55-0
2,2',3,5',6 - PeCB	95	93 + 95 + 98 + 100 + 102	38379-99-6
2,2',3,6,6' - PeCB	96		73575-54-9
2,2',3',4,5 - PeCB	97	86 + 87 + 97 + 108 + 119 + 125	41464-51-1
2,2',3',4,6 - PeCB	98	93 + 95 + 98 + 100 + 102	60233-25-2
2,2',4,4',5 - PeCB	99	83 + 99	38380-01-7
2,2',4,4',6 - PeCB	100	93 + 95 + 98 + 100 + 102	39485-83-1

Attachment 2.2
PCB Congener Co-Elution Table

PCB Congener	IUPAC NO.	CO-ELUTIONS	CAS Number
2,2',4,5,5' - PeCB	101	90 + 101 + 113	37680-73-2
2,2',4,5,6' - PeCB	102	93 + 95 + 98 + 100 + 102	68194-06-9
2,2',4,5',6 - PeCB	103		60145-21-3
2,2',4,6,6' - PeCB	104		56558-16-8
2,3,3',4,4' - PeCB	105		32598-14-4
2,3,3',4,5 - PeCB	106		70424-69-0
2,3,3',4',5 - PeCB	107	107 + 124	70424-68-9
2,3,3',4,5' - PeCB	108	86 + 87 + 97 + 108 + 119 + 125	70362-41-3
2,3,3',4,6 - PeCB	109		74472-35-8
2,3,3',4',6 - PeCB	110	110 + 115	38380-03-9
2,3,3',5,5' - PeCB	111		39635-32-0
2,3,3',5,6 - PeCB	112		74472-36-9
2,3,3',5',6 - PeCB	113	90 + 101 + 113	68194-10-5
2,3,4,4',5 - PeCB	114		74472-37-0
2,3,4,4',6 - PeCB	115	110 + 115	74472-38-1
2,3,4,5,6 - PeCB	116	85 + 116 + 117	18259-05-7
2,3,4',5,6 - PeCB	117	85 + 116 + 117	68194-11-6
2,3',4,4',5 - PeCB	118		31508-00-6
2,3',4,4',6 - PeCB	119	86 + 87 + 97 + 108 + 119 + 125	56558-17-9
2,3',4,5,5' - PeCB	120		68194-12-7
2,3',4,5',6 - PeCB	121		56558-18-0
2',3,3',4,5 - PeCB	122		76842-07-4
2',3,4,4',5 - PeCB	123		65510-44-3
2',3,4,5,5' - PeCB	124	107 + 124	70424-70-3
2',3,4,5',6 - PeCB	125	86 + 87 + 97 + 108 + 119 + 125	74472-39-2
3,3',4,4',5 - PeCB	126		57465-28-8
3,3',4,5,5' - PeCB	127		39635-33-1
2,2',3,3',4,4' - HxCB	128	128 + 166	38380-07-3
2,2',3,3',4,5 - HxCB	129	129 + 138 + 160 + 163	55215-18-4
2,2',3,3',4,5' - HxCB	130		52663-66-8
2,2',3,3',4,6 - HxCB	131		61798-70-7
2,2',3,3',4,6' - HxCB	132		38380-05-1
2,2',3,3',5,5' - HxCB	133		35694-04-3
2,2',3,3',5,6 - HxCB	134	134 + 143	52704-70-8
2,2',3,3',5,6' - HxCB	135	135 + 151 + 154	52744-13-5
2,2',3,3',6,6' - HxCB	136		38411-22-2
2,2',3,4,4',5 - HxCB	137		35694-06-5
2,2',3,4,4',5' - HxCB	138	129 + 138 + 160 + 163	35065-28-2
2,2',3,4,4',6 - HxCB	139	139 + 140	56030-56-9
2,2',3,4,4',6' - HxCB	140	139 + 140	59291-64-4
2,2',3,4,5,5' - HxCB	141		52712-04-6
2,2',3,4,5,6 - HxCB	142		41411-61-4
2,2',3,4,5',6 - HxCB	143	134 + 143	68194-15-0
2,2',3,4,5',6 - HxCB	144		68194-14-9
2,2',3,4,6,6' - HxCB	145		74472-40-5
2,2',3,4',5,5' - HxCB	146		51908-16-8
2,2',3,4',5,6 - HxCB	147	147 + 149	68194-13-8
2,2',3,4',5,6' - HxCB	148		74472-41-6
2,2',3,4',5',6 - HxCB	149	147 + 149	38380-04-0
2,2',3,4',6,6' - HxCB	150		68194-08-1

Attachment 2.2
PCB Congener Co-Elution Table

PCB Congener	IUPAC NO.	CO-ELUTIONS	CAS Number
2,2',3,5,5',6 - HxCB	151	135 + 151 + 154	52663-63-5
2,2',3,5,6,6' - HxCB	152		68194-09-2
2,2',4,4',5,5' - HxCB	153	153 + 168	35065-27-1
2,2',4,4',5,6' - HxCB	154	135 + 151 + 154	60145-22-4
2,2',4,4',6,6' - HxCB	155		33979-03-2
2,3,3',4,4',5 - HxCB	156	156 + 157	38380-08-4
2,3,3',4,4',5' - HxCB	157	156 + 157	69782-90-7
2,3,3',4,4',6 - HxCB	158		74472-42-7
2,3,3',4,5,5' - HxCB	159		39635-35-3
2,3,3',4,5,6 - HxCB	160	129 + 138 + 160 + 163	41411-62-5
2,3,3',4,5',6 - HxCB	161		74472-43-8
2,3,3',4',5,5' - HxCB	162		39635-34-2
2,3,3',4',5,6 - HxCB	163	129 + 138 + 160 + 163	74472-44-9
2,3,3',4',5',6 - HxCB	164		74472-45-0
2,3,3',5,5',6 - HxCB	165		74472-46-1
2,3,4,4',5,6 - HxCB	166	128 + 166	41411-63-6
2,3',4,4',5,5' - HxCB	167		52663-72-6
2,3',4,4',5',6 - HxCB	168	153 + 168	59291-65-5
3,3',4,4',5,5' - HxCB	169		32774-16-6
2,2',3,3',4,4',5 - HpCB	170		35065-30-6
2,2',3,3',4,4',6 - HpCB	171	171 + 173	52663-71-5
2,2',3,3',4,5,5' - HpCB	172		52663-74-8
2,2',3,3',4,5,6 - HpCB	173	171 + 173	68194-16-1
2,2',3,3',4,5,6' - HpCB	174		38411-25-5
2,2',3,3',4,5',6 - HpCB	175		40186-70-7
2,2',3,3',4,6,6' - HpCB	176		52663-65-7
2,2',3,3',4',5,6 - HpCB	177		52663-70-4
2,2',3,3',5,5',6 - HpCB	178		52663-67-9
2,2',3,3',5,6,6' - HpCB	179		52663-64-6
2,2',3,4,4',5,5' - HpCB	180	180 + 193	35065-29-3
2,2',3,4,4',5,6 - HpCB	181		74472-47-2
2,2',3,4,4',5,6' - HpCB	182		60145-23-5
2,2',3,4,4',5',6 - HpCB	183	183 + 185	52663-69-1
2,2',3,4,4',6,6' - HpCB	184		74472-48-3
2,2',3,4,5,5',6 - HpCB	185	183 + 185	52712-05-7
2,2',3,4,5,6,6' - HpCB	186		74472-49-4
2,2',3,4',5,5',6 - HpCB	187		52663-68-0
2,2',3,4',5,6,6' - HpCB	188		74487-85-7
2,3,3',4,4',5,5' - HpCB	189		39635-31-9
2,3,3',4,4',5,6 - HpCB	190		41411-64-7
2,3,3',4,4',5',6 - HpCB	191		74472-50-7
2,3,3',4,5,5',6 - HpCB	192		74472-51-8
2,3,3',4',5,5',6 - HpCB	193	180 + 193	69782-91-8
2,2',3,3',4,4',5,5' - OcCB	194		35694-08-7
2,2',3,3',4,4',5,6 - OcCB	195		52663-78-2
2,2',3,3',4,4',5,6' - OcCB	196		42740-50-1
2,2',3,3',4,4',6,6' - OcCB	197	197 + 200	33091-17-7
2,2',3,3',4,5,5',6 - OcCB	198	198 + 199	68194-17-2
2,2',3,3',4,5,5',6' - OcCB	199	198 + 199	52663-75-9
2,2',3,3',4,5,6,6' - OcCB	200	197 + 200	52663-73-7

Attachment 2.2
PCB Congener Co-Elution Table

PCB Congener	IUPAC NO.	CO-ELUTIONS	CAS Number
2,2',3,3',4,5',6,6' - OcCB	201		40186-71-8
2,2',3,3',5,5',6,6' - OcCB	202		2136-99-4
2,2',3,4,4',5,5',6 - OcCB	203		52663-76-0
2,2',3,4,4',5,6,6' - OcCB	204		74472-52-9
2,3,3',4,4',5,5',6 - OcCB	205		74472-53-0
2,2',3,3',4,4',5,5',6 - NoCB	206		40186-72-9
2,2',3,3',4,4',5,6,6' - NoCB	207		52663-79-3
2,2',3,3',4,5,5',6,6' - NoCB	208		52663-77-1
2,2',3,3',4,4',5,5',6,6' - DeCB	209		2051-24-3

MoCB = monochlorobipheny

DiCB = Dichlorobiphenyl

TriCB = Trichlorobiphenyl

TeCB = Tetrachlorobiphenyl

PeCB = Pentachlorobiphenyl

HxCB = Hexachlorobiphenyl

HpCB = Heptachlorobiphenyl

OcCB = Octachlorobiphenyl

NoCB = Nonachlorobiphenyl

DeCB = Decachlorobiphenyl

Attachment 3

SOP 1- Procedure to Conduct Sample Management for CLP and non-CLP Samples

Title: Procedure to Conduct Sample Management for CLP and non-CLP Samples

I. Introduction

This guideline is to provide reference information on sample management procedures.

II. Definitions

Contract Laboratory Program (CLP). The U.S. Environmental Protection Agency (USEPA) CLP was developed to retain laboratory services that will ensure that all environmental samples collected under the Superfund Program will be analyzed in accordance with recognized USEPA laboratory methods and quality assurance/quality control (QA/QC) procedures.

Target Compound List (TCL). This list refers to organic compounds typically analyzed for by the CLP. The list is broken into three subdivisions; volatiles, semi-volatiles, and pesticide/polychlorinated biphenyls(PCBs).

Target Analyte List (TAL). This list references inorganic parameters typically analyzed for by the CLP. Parameters on this list include heavy metals and cyanide.

Routine Analytical Services (RAS). Laboratory analysis for substances or parameters shown on the TCL and TAL in solid and aqueous samples.

non-RAS. Laboratory analysis for substances or parameters not shown on the TCL and TAL. Analysis of non-soil/sediment, nonaqueous matrices, and analysis of RAS compounds using non-RAS protocols.

Trip Blanks. Trip blanks are used to check for sample contamination originating from sample transport and shipping, as well as from site conditions. Trip blanks are necessary when aqueous environmental samples are collected for volatile organic analysis and when semi permeable membrane devices (SPMD) samples are collected.

Rinsate Blanks. Rinsate blanks, also known as field blanks, are used to check the efficacy of sampling equipment decontamination procedures. Rinsates are collected for each type of sampling equipment used on site. Demonstrated analyte-free water is poured over the equipment and collected into containers and analyzed for the analytes of concern.

Environmental Duplicate. These duplicates are two separate samples collected at the same sampling point. Environmental duplicates are used to determine field sampling precision and are collected at a set frequency for each analyte group. For VOC samples, duplicate

samples are collocated samples. For all other parameters, a sample aliquot is homogenized and split into two sampling containers.

Matrix Spike/Matrix Spike Duplicates (MS/MSD). This process involves adding standard known mixtures of various organic TCL compounds to environmental samples prior to extraction. The sample is split into duplicates and analyzed. The analysis is used to evaluate the matrix effect of the sample upon the analytical methodology. Triple volume of aqueous samples for MS/MSD analysis is collected in the field, at a frequency of at least 5 percent per matrix/concentration. No extra volume is required for the soil samples.

Matrix Spike/Matrix Duplicates (MS/MD). The spike analysis is the process by which standard mixes of various inorganic TAL parameters are added to environmental samples prior to digestion. The analysis is used to evaluate the matrix effect of the sample upon the analytical methodology. The duplicate analysis in the process where the assigned sample is split in two and analyzed at the laboratory. The analysis is an indicator of a laboratories analytical precision based on each sample matrix. Double volume of aqueous samples for MS/MD analysis is collected in the field, at a frequency of at least 5 percent per matrix/concentration. No extra volume is required for soil samples.

Low-Concentration Sample. Samples in which a compound may be present at concentration levels less than 10.0 ppm.

Medium-Concentration Sample. Samples in which a compound may be present at concentration levels equal to or greater than 10.0 ppm to as much as 15 percent (150,000 ppm) of the total sample.

High-Concentration Sample. Samples in which a compound may be present at concentration levels greater than 15 percent (150,000 ppm) of the total sample.

III. Guidelines

The purpose of sample management is to assure that all samples collected during this hazardous waste site investigation are accounted for when the project is completed. The sample management officer is also responsible for assuring that the proper quality assurance/quality control (QA/QC) samples are collected. These purposes are achieved by adhering to the following procedures:

1) Laboratory Coordination

a) CLP Samples

Prior to collecting any samples, a request must be made through the Regional Sample Control Center (RSCC) for a laboratory. At this time, any requested modifications to the CLP statement of work (SOW) must also be described (*e.g.*, lower detection limits, adding a parameter, such as titanium, to the TAL, requesting a quicker

turnaround time (TAT)). A description of how to request CLP services is including in Section 2.4 of USEPA's CLP Guidance for Field Samplers, OSWER 9240.0-35, August 2004. A request for CLP services includes the following:

- i) Contact RSCC to obtain CLP sample numbers – these are unique numbers used to identify each sample. For this project, a large block of CLP numbers will be set aside by RSCC prior to beginning sampling. Therefore, it is likely that these numbers will only need to be requested once.
- ii) Fill out an RSCC request form. This request must be sent to RSCC by 12:00 pm on the Tuesday prior to week of the sampling event.
- iii) RSCC will contact the originator of the request by Friday prior to the sampling event with the Case Number and assigned laboratories. At times, the USEPA-DESA Laboratory may choose to perform all or part of the analysis requested.

b) Non CLP Samples

Three prime subcontractor laboratories will be procured for the Lower Passaic River Restoration Project (LPRRP) CPG Oversight project to conduct analysis of non-CLP parameters. Weekly contact must be maintained with these laboratories to inform them of upcoming sampling.

2) Preparing the Sample Containers

- a) Malcolm Pirnie will purchase certified clean sample containers from an approved supplier. Copies of these certifications will be brought to the site while sampling and then kept in site files for future reference.
- b) Each bottle used to collect a sample must be identified by a supplier and lot number to ensure that it is permanently associated with the sample collected in that particular container. This procedure also applies to containers used to carry demonstrated analyte-free water to be used for blank preparation. This is to ensure that for all samples collected; the specific sample bottles used can be traced to the sample container contractor, QC certification paperwork, and custody records applicable to their identifying lot numbers.

3) QA/QC Samples

a) VOC Trip Blanks

- i) One trip blank is required for each day that aqueous environmental samples are collected for volatile analysis.
- ii) Trip blanks are only necessary for aqueous environmental samples. If rinsates are the only aqueous samples collected, then a trip blank is not necessary.

- iii) Trip blanks consist of two 40 mL septum vials into which 4-5 drops of 1:1 hydrochloric acid (HCl) is introduced prior to filling them with demonstrated analyte-free water.
 - iv) Trip blanks are prepared in the field in the clean zone. They then remain with the field personnel throughout the sampling event and are shipped with the volatile cooler. Every aqueous environmental sample cooler must contain a trip blank in it.
 - v) The trip blank must be stored away from solvents and must be preserved, packaged, cooled to $4 \pm 2^{\circ}\text{C}$ and shipped to the laboratory with the other aqueous samples.
- b) Environmental Duplicates
- i) Samples for duplicate analysis are collected in the field, for each matrix sampled at a frequency as described in Lab Task Order.
 - ii) Sufficient quantity of matrix must be collected from the same sample location to fill a duplicate set of sample containers. The duplicate volume is shipped to the laboratory under a separate CLP sample number.
 - iii) For soil/sediment samples the volatile organic fraction is collected as collocated grab samples while the non-volatile fraction is homogenized prior to collection.
- c) Matrix Spike/Matrix Spike Duplicate (MS/MSD) & Matrix Spike/Matrix Duplicate (MS/MD)
- i) The designation of a sample for MS/MSD analysis for organics and MS/MD analysis for inorganics is required for 1 in 20 environmental samples per concentration/matrix.
 - ii) Three times the total volume is necessary for collection of aqueous MS/MSD organic samples. Two times the total volume is necessary for collection of aqueous inorganic MS/MD samples. No extra volume is required for the soil samples.
 - iii) MS/MSD and MS/MD samples are noted as such on the chain of custody (COC).

4) Sample Documentation, Packaging, and Shipping Procedures

One or more of the field personnel will be designated as the sample management officer(s). The sample management officer will bear the ultimate responsibility for the documentation, packaging, and shipping of the samples. These procedures are outlined below.

a) Documentation/Chain of Custody

For documentation purposes, the field team may enter information about each sample into a notebook or a laptop computer as they collect the sample. COC forms should be completed when the samples are transferred. Examples of COC forms for transferring split samples to Malcolm Pirnie Inc and from Malcolm Pirnie Inc to the laboratories for the LPRRP split samples are given in Attachments 5.1 to 5.4 of the LPRRP study area FSP/QAPP Addendum. Samples for an assigned CLP laboratory should to be documented using Forms II Lite software.

Information typically recorded includes the following:

- Sample date and time of collection
- Associated QC samples
- Analyses required
- MALCOLM PIRNIE-designated sample number (CPG # with suffix “-MPI”)
- For CLP samples only, the assigned CLP Number
- The month, day, and year the sample was collected
- The type of analysis requested
- The type of preservation performed in the field.

For information on the use of Forms II Lite refer to the Forms II Lite User’s Guide.

b) Packaging and Shipping Samples

- i) Make sure the caps on the sample bottles are tightly sealed. Wipe down the outside of all of the sample bottles.
- ii) Preserve the samples according to QAPP Worksheet #19.
- iii) Apply one custody seal around the circumference of the container or over the cap and onto the sides of the container. The custody seal must applied to sample containers in such a manner as to reveal if the container was opened during transit.
Note: Septum vials should not be covered over the top.
- iv) Place each container in its own ziplock bag. The two 40 ml vials may be placed in one bag. Eliminate extra air space from the bag before sealing. The EnCore® device comes in its own ziplock bag and this bag will be used.
- v) For CLP samples, place the associated sample tag into the ziplock bag with the sample.
- vi) Prepare the shipping container (usually a cooler). The cooler will be prepared so that no leakage can occur during shipping. All valves on the cooler will be securely duct taped, both inside and outside the cooler, and the cooler will be lined with either plastic or a large garbage bag. Only coolers that conform to the general design requirements in 49 CFR 173.410 will be used for shipment.
- vii) The VOC samples should be packed together, without any other sample fraction, with the trip blank.
- viii) Put 1-2 inches of packing material in the bottom of the coolers, then place the samples into the cooler.

- ix) Surround the sample bottles with bags of ice. The ice will not be kept in its original bag, but will be repacked into ziplock bags. Use enough ice to ensure that the proper temperature ($4 \pm 2^{\circ}\text{C}$) is maintained during transport. Place a temperature blank (40-mL vial filled with deionized water) into the cooler.
- x) Place packing material over and around the sample bottles. Sufficient packing material must be used so the bottles will not move or break during transport.
- xi) Once the samples are packed, the plastic or garbage bag will be closed and securely taped.
- xii) Prior to shipment the relinquished by and received by sections of the COC form will be filled in. Generally, the shipper will not sign the COC. Therefore, the carrier's name is filled in by the sample management officer. The original COC form will then be placed in a ziplock bag and taped to the inside of one of the lead cooler; one copy of the COC form(s) will be placed in a ziplock bag(s) and placed in the other cooler(s).
- xiii) For CLP samples, one copy of the COC form will be retained by the sample management officer and one copy will be sent to RSCC. For non-CLP samples, one copy of the COC form will be retained by the sample management officer.
- xiv) Close the cooler and seal with strapping tape. If visibly dirty, the outside of the cooler will be wiped down. Apply signed and dated custody seals to the cooler. Place two custody seals diagonally across from each other where the cooler lid meets the cooler. The custody seals will be applied in such a manner as to reveal if the cooler was opened during transit.
- xv) An address label will be placed on the outside of each cooler. The label will be covered with clear tape. If more than one cooler is being sent to one destination, each cooler will be appropriately labeled as 1 of X, 2 of X, *etc.* The airbill will be attached to one of the coolers. Usually, the samples will be sent via overnight carrier for next day delivery. This should be confirmed with the Field Team Leader.
- xvi) The laboratory will be notified of the shipment before 9 a.m. ET on the day after shipping. For CLP samples, fill out the Sample Shipping Call-In Form. Call or fax the shipping information to RSCC by 9:00 am the following morning. For non-CLP samples, the notification system agreed to in the subcontract will be followed.

Note: Some samples have very short holding times. In some limited instances, the samples may be either hand delivered to a laboratory or picked up by the laboratory's courier service.

Attachment 4

Example of non-CLP Chain of Custody (COC) Form

ATTACHMENT 4

**EXAMPLE OF
NON-CLP CHAIN OF CUSTODY FORM (for Axys)**

Chain of Custody Record							TAT: PCB cong. _____ TOC _____ Dioxin/furans _____ Pesticides _____ Other: _____				Case No: _____ DAS No: _____ SDG No: _____				
Date Shipped: Carrier Name: Airbill: Shipped to: Axys Analytical Services, Ltd. 2045 Mills Road Sidney, British Columbia, CANADA V8L 3S8							Chain of Custody Record					Sampler Signature: _____		For Lab Use Only	
							Relinquished by: _____ (Date/Time) _____					Received by: _____ (Date/Time) _____		Lab Contract No: _____ Unit Price: _____ Transfer to: _____	
							1. _____					1. _____			
							2. _____					2. _____			
							3. _____					3. _____			
3. _____															
4. _____					4. _____										

CHAIN OF CUSTODY													
Sample No.	Matrix	Sampler	Conc/Type	Preservative	Location	Collection Date/Time	PCB Congeners (EPA 1668A)	Dioxin/Furans (EPA 1613B)	Pesticides (HRGC-HRMS)	PAHs	Other	Remark	For Lab Use Only Sample Condition Upon Receipt
e.g. SGXX-XXX	Sediment						X	X	X	X			
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
Shipment for case complete (Y or N)?			Sample to be used for laboratory QC:			Additional Sampler Signature(s):			Cooler Temperature upon receipt:			Chain of Custody Seal Number:	
Concentration: L = low, M = low/medium, H = High						Type/Designate: C = Composite, G = Grab						Custody Seals Intact?	Shipment Iced?

Attachment 5

SOP 2 - Procedure to Conduct Sample Preservation

Title: Procedure to Conduct Sample Preservation

I. Introduction

This guideline is to provide reference information on the accepted methods of sample preservation.

II. Materials

Preservatives:

- a. 1:1 HCl - (Hydrochloric Acid/Deionized Water)
- b. HNO₃ - full strength (Nitric Acid)
- c. NaOH - 10 N (Sodium Hydroxide)
- d. H₂SO₄ - full strength (Sulfuric Acid)

Additional Materials:

- a. Disposable Pasteur pipettes
- b. Pipette pumps - 10 ml or 2 ml
- c. Latex pipette bulbs
- d. Squeeze bottle with deionized water
- e. Clear wide mouth glass jar for water pipette
- f. Paper towels
- g. Lead acetate paper
- h. Cadmium nitrate or cadmium carbonate (if using lead acetate paper)
- i. Potassium iodide - starch test paper (KI-starch paper)
- j. Ascorbic Acid (if using KI starch paper)
- k. Filter paper
- l. Filter funnels (disposable or decontaminated)
- m. Filter vessel with hand pump
- n. pH paper
- o. Scale

Safety Materials:

- a. 2 pair safety glasses
- b. 2 pair solvex gloves
- c. 2 lab coats
- d. MSDS sheets
- e. Eyewash

III. Discussion

Complete and unequivocal preservation of samples is a practical impossibility. At best, preservation techniques slow down the chemical and biological changes that inevitably continue after the sample is removed from the parent source. The changes that take place in a sample are either chemical or biological. In the former case, certain changes occur in the chemical structure of the constituents that

are a function of physical conditions. Metal cations may precipitate as hydroxides or form complexes with other constituents; cations or anions may change valence states under certain reducing or oxidizing conditions; other constituents may dissolve or volatilize with the passage of time; and metal cations may also adsorb onto surfaces (glass, plastic, quartz, *etc.*). Biological changes taking place in a sample may change the valence of an element or a radical to a different valence. Soluble constituents may be converted to organically bound materials in cell structures, or cell lysis may result in release of cellular material into solution. The well known nitrogen and phosphorus cycles are examples of biological influence on sample composition. Therefore, as a general rule, it is best to analyze the samples as soon as possible after collection. This is especially true when the analyte concentration is expected to be in the low ug/l range.

Methods of preservation are relatively limited and are intended generally to (1) retard biological action, (2) retard hydrolysis of chemical compounds and complexes, (3) reduce volatility of constituents, and (4) reduce absorption effects. Preservation methods not outlined below are generally limited to pH control, chemical addition, refrigeration, and freezing.

IV. Guidelines

All Samples

With few exceptions, most samples need to be cooled to between 4-6 °C immediately after sample collection.

Preserving Aqueous Volatile Organic Compound (VOC) Samples

Equipment

Field personnel should take the following materials for VOC sample preservation to the sampling locations:

1. One 40-mL VOA vial containing 1:1 HCl.

The 1:1 HCl should be transferred on site from a 1-liter plastic-coated glass bottle to one properly labeled 40-mL glass vial by using a glass funnel. This should be performed at the field office. Hand and eye protection must be worn during the transfer and handling of hydrochloric acid. Field personnel must attempt to keep the 40 ml vial in an upright position during field sampling. The 1-liter plastic-coated bottle must be kept at the field office; the 40-mL vial must be kept in a plastic ziplock bag.

2. Plastic ziplock bag containing pH indicator strips for each sampling location.
3. Latex gloves
4. Eye protection
5. Plastic ziplock bag for disposal of used pH indicator strips and latex gloves.

Preservation Procedures

1. For each different type of aqueous sample to be collected (*e.g.*, river sample, CSO sample) a test sample must be preserved to determine if the preservation procedure will cause an adverse reaction. Note that a test vial must also be collected when the temperature changes (*e.g.*, each season) and whenever a sample is significantly different in appearance than the test sample. First, fill a test vial one-half full with the sample matrix to be collected. Note the color and clarity of the sample.
2. Test the pH by inserting one pH paper strip into the test vial. If the pH is less than 2.0, as indicated by a blue color on the strip, collect the samples without acidifying. Document this in the field application. The field sample management officer must document the sample as not preserved on the COC. If the pH is greater than 2.0, continue to Step 3. The pH indicator paper strip should be put into a plastic bag for later disposal.
3. Dispense 10 drops of 1:1 HCl from the pipette. Tap the vial gently to mix. If color develops, precipitates form, effervescing occurs, or an exothermic reaction (heat generation determined by holding the vial firmly) occurs, do not acidify the samples and document the reason for not acidifying in the field application. This information should also be included on the COC. If none adverse reactions occur when acid is added to the sample, proceed to Step 4.
4. Test the pH of the sample. If the pH is less than 2.0, proceed to Step 5. If the pH is greater than 2.0, add 1:1 HCl a few drops at a time (keeping count) until the pH is less than 2.0; then proceed to Step 5.
5. Fill the test vial with sample until the vial is nearly full to the top. Gently tap the side of the vial to mix, and test the pH of the sample. If the pH is less than 2.0 proceed to the next step. If the pH is greater than 2.0, again add 1:1 HCl a few drops at a time (keeping count) until the pH falls below 2.0. Proceed to the next step.
6. Note the amount of 1:1 HCl added to the test vial. Add this amount of 1:1 HCl to all of the samples, using the same glass pipette, after collecting the samples, and before capping the 40 ml vials. To avoid cross contamination, the sampler must be extremely cautious not to touch the glass pipette to the sides of the vial or the sample. Document the approximate quantity of 1:1 HCl added to each sample. These samples are then packaged and cooled to 4°C prior to shipping to the CLP laboratory.
7. Store the samples at 4°C until the time of analysis.
8. Properly dispose of the test vials and all used sample preservation equipment.

Preserving Aqueous Inorganic Samples with Acid

1. Add the acid to the sample using a pipette. Typically, depending on the size of the pipette and the original pH of the sample, approximately ½ a pipette of acid is required per liter of sample. Recap the sample bottle and turn it gently upside down to mix the contents.
2. Check the pH by pouring an aliquot of the sample over the pH paper; do not dip the pH paper directly into the sample. The pH of the sample should be < 2.
3. If the sample contains a significant particulate fraction, acidification without filtration could result in deceptively high values for the aqueous sample. Varying amounts of particulate matter can also give large differences in metal values for duplicate acidified aqueous samples. Observation, therefore, should be made and recorded in the field application and also noted on the COC. If an obvious change is observed during sample preservation, which may bias the results, the Site Quality Control Officer (SQC) should be consulted.

3. If the pH is still > 2 , repeat steps 1 and 2 until the pH is < 2 .
4. Store the samples at 4°C until the time of analysis.

Preserving Aqueous Cyanide Samples

1. Test a drop of sample with potassium iodide-starch test paper (KI-starch paper). A resulting blue color indicates the presence of oxidizing agents and the need for treatment. Add ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add an additional 0.6 g of ascorbic acid for each liter of sample volume.
2. Add NaOH to the sample using a pipette. Typically, depending on the original pH of the sample, approximately 2 mL of NaOH per liter of sample is required. Recap the sample bottle and turn it gently upside down to mix the contents.
3. Check the pH by pouring an aliquot of the sample over the pH paper; do not dip the pH paper directly into the sample. The pH of the sample should be > 12 .
4. If the pH is still < 12 , repeat steps 2 and 3 until the pH is > 12 .
5. Store the samples at 4°C until the time of analysis.

Refer to the sample preservation tables (3-1 to 3-6) in the QAPP for specific sample preservation requirements.

Preservation of Biological Samples

Additional requirements for the preservation of biological samples are contained in the individual SOPs for the type of sample being collected.

Attachment 6

Axys Analytical Services, Inc. Method Summaries

DETERMINATION OF ORGANOCHLORINE PESTICIDES, PCB'S, AND POLYCHLORINATED DIBENZODIOXINS/FURANS (PCDD/F) BY HRGC/HRMS BY AXYS METHOD MLA-013

This method is applicable to the analysis of solids, tissues (including milk and blood), aqueous samples, XAD columns, air samples and solvent extracts for which sample size is limited. Samples may be analyzed for some or all of the following suites of analytes: PCDD/Fs, PCBs (209 or toxics) and chlorinated pesticides.

Samples are spiked with the appropriate suite(s) of isotopically labelled surrogate standards prior to extraction. Samples are solvent extracted. The extracts are cleaned up and fractionated using a series of chromatographic columns that may include silica, Florisil, carbon/Celite, alumina and gel permeation columns. The sequence of columns used is dependant upon the suite(s) of target analytes to be isolated (Figures 1 and 2). One fraction is spiked with ¹³C-labelled PCDD/F recovery (internal) standard(s) and analyzed for PCDD/F according to EPA method 1613B. Another fraction is spiked with ¹³C-labelled PCBs and pesticides and analyzed for PCBs according to EPA method 1668A and for pesticides by HRGC/HRMS. A third fraction is spiked with ¹³C-labelled pesticides and analyzed for the most polar pesticides by HRGC/HRMS. Details of the instrumental analysis and quantification procedures for each suite of target analytes is presented in the following documents:

Analysis Type	AXYS Document ID	Title
Chlorinated pesticides	MSU-021	HRGC/HRMS Pesticide Method Summary (MLA-028)
PCBs	MSU-020	Method Summary of EPA 1668A (MLA-010)
PCDD/F	MSU-018	Method Summary of EPA 1613B (MLA-017)

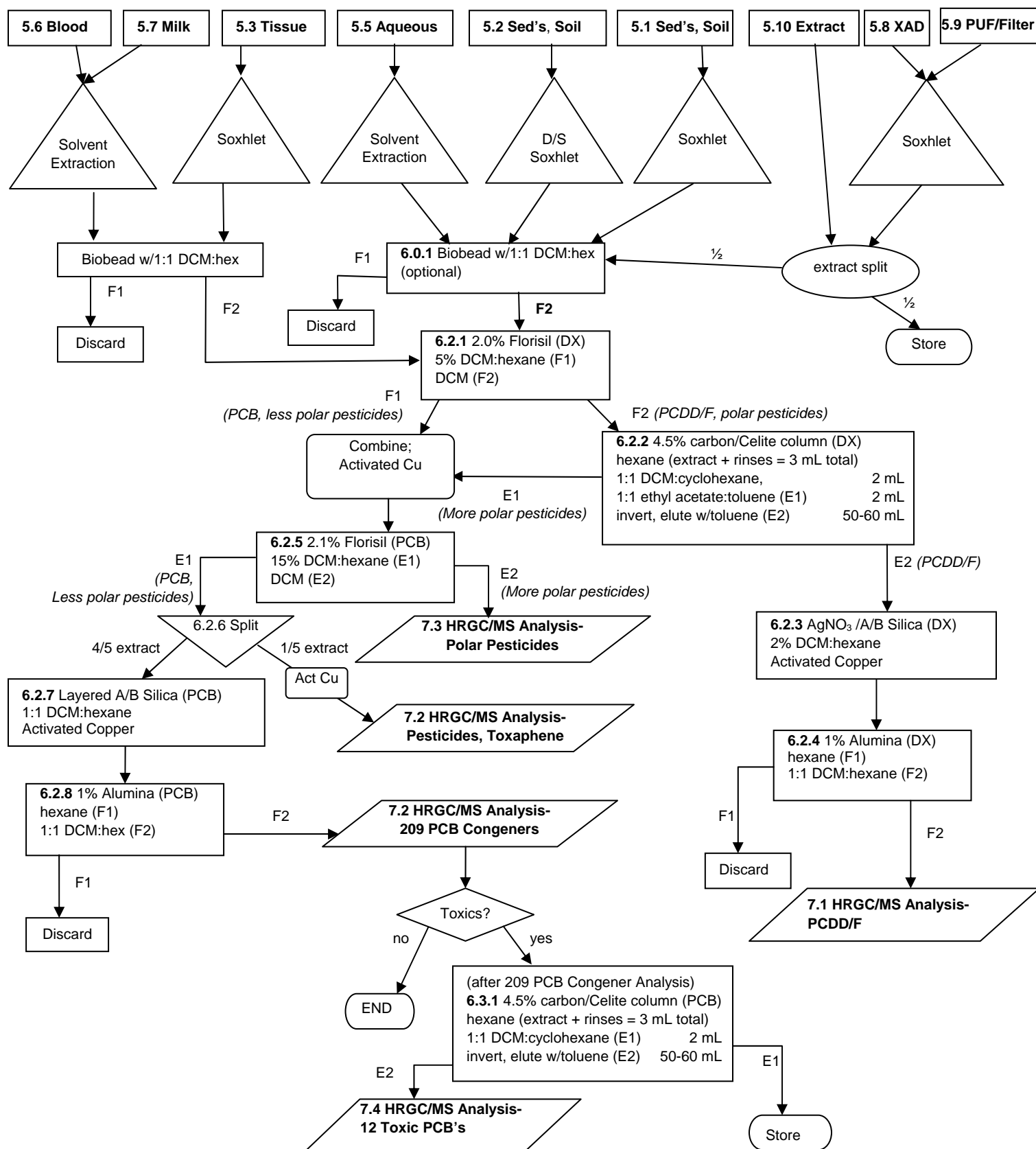
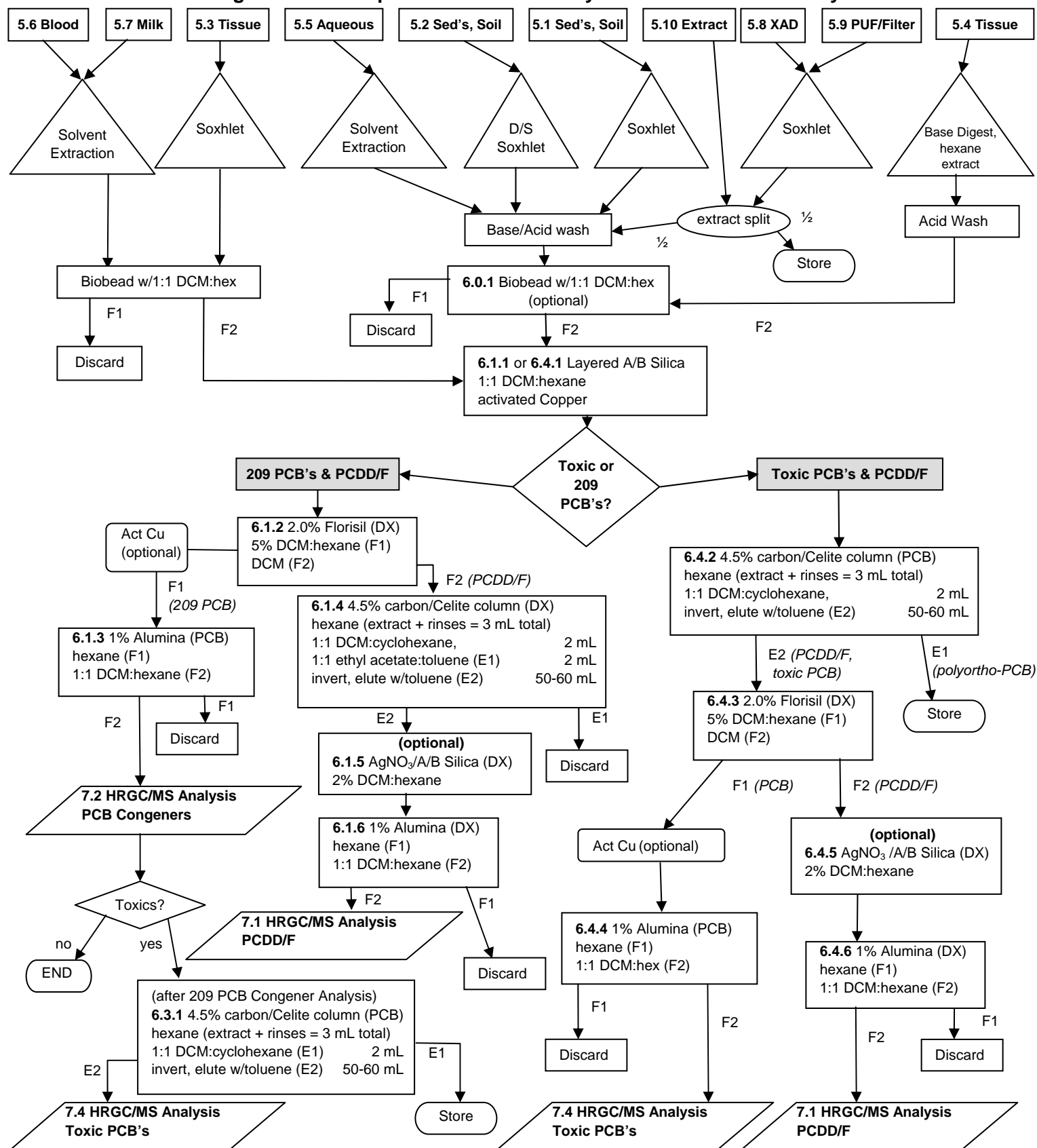
Figure 1: Clean-up Procedures for Analysis of 209 PCB's, PCDD/F and Pesticides


Figure 2: Clean-up Procedures for Analysis of PCB & PCDD/F only



**ANALYSIS OF POLYCHLORINATED DIOXINS AND FURANS
BY EPA METHOD 1613B**

Samples are spiked with a suite of isotopically labelled surrogate standards prior to analysis, solvent extracted, and cleaned up through a series of chromatographic columns that may include gel permeation, silica, Florisil, carbon/Celite, and alumina columns. The extract is concentrated and spiked with an isotopically labelled recovery (internal) standard. Analysis is performed using a high-resolution mass spectrometer coupled to a high-resolution gas chromatograph equipped with a DB-5 capillary chromatography column (60 m, 0.25 mm i.d., 0.1 µm film thickness). A second column, DB-225 (30 m, 0.25 mm i.d., 0.15 µm film thickness), is used for confirmation of 2,3,7,8-TCDF identification. All procedures are carried out according to protocols as described in EPA Method 1613B, with the significant modifications summarized below. The data are evaluated against QC criteria presented in Tables 1 and 2.

Method Modifications:***Section 2.1.2***

Non-aqueous liquid from multiphase sample is combined with the solid phase and extracted by Dean Stark soxhlet.

Section 7.2.1

Anhydrous sodium sulphate (Na_2SO_4) is purchased in powder form (not granular) and is baked overnight prior to use. There is no solvent rinse with dichloromethane.

Section 7.10

The concentration of the labelled compound spiking solution is 100 ng/mL (except for OCDD which is 200 ng/mL) and the sample spiking volume is 20 µL. The resulting concentrations in the final extracts are as specified in the method.

Section 7.11

The concentration of the clean-up standard spiking solution is 10 ng/mL and the sample spiking volume is 20 µL. The resulting concentration in the final extracts are as specified in the method.

Sections 7.13, 14.0, 15.0

An additional lower level calibration solution, 0.2 times the concentration of CS1, is prepared and included in the initial calibration series. Initial calibration is based on a six-point series.

Section 7.14

The concentration of the PAR spiking solutions is 0.2/1.0/2.0 ng/mL for tetra/penta, hexa, hepta, hexa/octas respectively and the spiking volume is 1 mL. The resulting final concentration in the extracts are as specified in the method.

Section 9.3.3, Table 7

Acceptance criteria for the percent recovery of surrogate standards in samples have been revised. Criteria that are higher than 130% have been lowered to 130%, as presented in Table 1.

Section 11.5

Aqueous samples containing >1% visible solids are prepared and extracted using the same procedure as samples containing $\leq 1\%$ visible solids. This involves extracting the solids by soxhlet and the filtrate by separatory funnel extraction and combining the extract from the two phases.

Section 12.0

Samples with sufficiently low moisture content may be mixed with Na_2SO_4 and extracted using regular soxhlet apparatus in 80:20 toluene:acetone.

Section 12.4

The equilibration time for the sodium sulphate drying step is that required to produce a dry, free flowing powder (minimum thirty minutes). This may be less than the 12-hour minimum specified in EPA 1613B.

Section 12.5.1

Samples are spiked with cleanup standard right after extraction and before reduction; not spiked into the separatory funnels containing the extracts prior to the acid/base wash.

Section 12.6.1.1

Rotary evaporator baths are maintained at 35°C. Mimic proofs are collected instead of collecting proofs each day and archiving.

Section 13.0

Extracts may be cleaned up on silica, alumina and carbon chromatographic columns using a Fluid Management System (FMS) automated cleanup system.

Section 13.7

Gravimetric lipid analysis is carried out on two subsamples of the extract.

Sections 14.0, 15.0, 16.0, Table 8, Table 9

M/Z channels 354/356 and 366/368 are used to confirm and quantify the native and surrogate penta-substituted dioxins, respectively; this change from the method's specification is made in the instrument method in order to avoid a persistent interference in the 356/358 and 368/370 M/Z channels. The theoretical ratio for the P5CDD M/M+2 ions is 0.61; therefore, the acceptance range is 0.52 - 0.70.

Section 15.3.5, Table 6

Acceptance criteria for calibration verification concentrations have been modified, as presented in Table 1, so that ranges do not exceed 70-130% of the test concentration.

Section 15.5.3 Table 6

Acceptance specifications for OPR concentrations have been modified, as presented in Table 1, so that ranges do not exceed 70-130%.

Section 17.0

Conc_i - the concentrations of target analytes, and the labelled compound concentrations and recoveries, are calculated using the equations below. These procedures are equivalent to those described in the method but are more direct.

$$Conc_i = \frac{A_i}{A_{si}} \times \frac{M_{si}}{RRF_{i,si}} \times \frac{1}{M_x}$$

- where A_i = summed areas of the primary and secondary m/z's for the analyte peak of interest (compound i)
- A_{si} = summed areas of the primary and secondary m/z's for the labelled surrogate peak used to quantify i)
- M_x = mass of sample taken for analysis
- M_{si} = mass of labelled surrogate (compound si) added to sample as calculated by the concentration of standard spiked (pg/mL) multiplied by the volume spiked (mL)
- $RRF_{i,si}$ = mean relative response factor of i to si from the five-point calibration range and defined individually as:

$$\frac{A_i}{A_{si}} \times \frac{M_{si}}{M_i}$$

Calculation of Surrogate Standard Concentrations and Percent Recoveries:

Concentrations of surrogate standards are calculated using the following equation:

$$Conc_{si} = \frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{RRF_{si,rs}}$$

and, the percent recoveries of the surrogate standards are calculated using the following equation:

$$\%Recovery = \frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{RRF_{si,rs}} \times \frac{1}{M_{si}} \times 100$$

- where A_{rs} and A_{si} are the summed peak areas (from the primary and secondary m/z channels) of recovery standard and labelled surrogate added to the sample;
- M_{rs} and M_{si} are the masses of recovery standard and labelled surrogate added to the sample, and;
- $RRF_{si,rs}$ is the mean relative response factor of the labelled surrogate to the recovery standard as determined by the five-point calibration range and defined individually as:

$$\frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{M_{si}}$$

Section 17.5

Extracts may be diluted with solvent and re-analyzed by GC/MS isotope-dilution to bring the instrumental response to within the linear range of the instrument. For very high-level samples where a smaller sample aliquot may not be representative, extracts may be diluted and re-spiked with labelled quantification standards and re-analyzed by GC/MS to bring the instrumental response analytes within range. Final results may be recovery corrected using the mean recovery of labelled quantification standards.

Table 1. QC Acceptance Criteria for PCDD/F in CAL/VER, IPR, OPR and Test Samples¹

	Test Conc ng/mL	IPR ²		OPR ³ (%)	I-CAL %	CAL/VER ⁴ (%)	Labelled Cmpd %Rec. in Sample	
		RSD (%)	X(%)				Warning Limit	Control Limit
Native Compound								
2,3,7,8-TCDD	10	28	83-129	70-130	20	78-129	-	-
2,3,7,8-TCDF	10	20	87-137	75-130	20	84-120	-	-
1,2,3,7,8-PeCDD	50	15	76-132	70-130	20	78-130	-	-
1,2,3,7,8-PeCDF	50	15	86-124	80-130	20	82-120	-	-
2,3,4,7,8-PeCDF	50	17	72-150	70-130	20	82-122	-	-
1,2,3,4,7,8-HxCDD	50	19	78-152	70-130	20	78-128	-	-
1,2,3,6,7,8-HxCDD	50	15	84-124	76-130	20	78-128	-	-
1,2,3,7,8,9-HxCDD	50	22	74-142	70-130	35	82-122	-	-
1,2,3,4,7,8-HxCDF	50	17	82-108	72-130	20	90-112	-	-
1,2,3,6,7,8-HxCDF	50	13	92-120	84-130	20	88-114	-	-
1,2,3,7,8,9-HxCDF	50	13	84-122	78-130	20	90-112	-	-
2,3,4,6,7,8-HxCDF	50	15	74-158	70-130	20	88-114	-	-
1,2,3,4,6,7,8-HpCDD	50	15	76-130	70-130	20	86-116	-	-
1,2,3,4,6,7,8-HpCDF	50	13	90-112	82-122	20	90-110	-	-
1,2,3,4,7,8,9-HpCDF	50	16	86-126	78-130	20	86-116	-	-
OCDD	100	19	86-126	78-130	20	79-126	-	-
OCDF	100	27	74-146	70-130	35	70-130	-	-
Surrogate Standards								
¹³ C ₁₂ -2,3,7,8-TCDD	100	37	28-134	25-130	35	82-121	40-120	25-130
¹³ C ₁₂ -2,3,7,8-TCDF	100	35	31-113	25-130	35	71-130	40-120	24-130
¹³ C ₁₂ -1,2,3,7,8-PeCDD	100	39	27-184	25-150	35	70-130	40-120	25-130
¹³ C ₁₂ -1,2,3,7,8-PeCDF	100	34	27-156	25-130	35	76-130	40-120	24-130
¹³ C ₁₂ -2,3,4,7,8-PeCDF	100	38	16-279	25-130	35	77-130	40-120	21-130
¹³ C ₁₂ -1,2,3,4,7,8-HxCDD	100	41	29-147	25-130	35	85-117	40-120	32-130
¹³ C ₁₂ -1,2,3,6,7,8-HxCDD	100	38	34-122	25-130	35	85-118	40-120	28-130
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	100	43	27-152	25-130	35	76-130	40-120	26-130
¹³ C ₁₂ -1,2,3,6,7,8-HxCDF	100	35	30-122	25-130	35	70-130	40-120	26-123
¹³ C ₁₂ -1,2,3,7,8,9-HxCDF	100	40	24-157	25-130	35	74-130	40-120	29-130
¹³ C ₁₂ -2,3,4,6,7,8-HxCDF	100	37	29-136	25-130	35	73-130	40-120	28-130
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD	100	35	34-129	25-130	35	72-130	40-120	23-130
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF	100	41	32-110	25-130	35	78-129	40-120	28-130
¹³ C ₁₂ -1,2,3,4,7,8,9-HpCDF	100	40	28-141	25-130	35	77-129	40-120	26-130
¹³ C ₁₂ -OCDD	200	48	20-138	25-130	35	70-130	25-120	17-130
Cleanup Standard								
³⁷ Cl ₄ -2,3,7,8-TCDD	10	36	39-154	31-130	35	79-127	40-120	35-130

¹ QC acceptance criteria for IPR, OPR, and samples based on a 20 µL extract final volume² IPR: Initial Precision and Recovery demonstration³ OPR: Ongoing Precision and Recovery test run with every batch of samples.⁴ CAL VER: Calibration Verification test run at least every 12 hours

Table 2. QC Specifications for QC Samples, Instrumental Analysis, and Analyte Quantification

QC Parameter	Specification
Analysis Duplicate	Must agree to within $\pm 20\%$ of the mean (applicable to concentrations >10 times the DL) ¹
Procedural Blank	Blood: TCDD/F <0.2 pg/sample, PeCDD/F <0.5 pg/sample, HxCDD/F and HpCDD/F <1.0 pg/ sample, OCDD/F <5 pg/sample Other Matrices: TCDD/F <0.5 pg/sample, PeCDD/F, HxCDD/F, HpCDD/F <1.0 pg/sample, OCDD/F <5 pg/sample Higher levels acceptable where all sample concentrations a $>10X$ the blank
Detection Limit	SDL Requirements Blood: Tetra-penta-CDD/F 0.2 pg/sample Hexa-octa-CDD/F 0.5 pg/sample Other Matrices: 1 pg/sample
Instrument Carryover: Toluene Blank Samples	A. 1 st toluene blank following CAL-VER must have <0.6 pg TCDD and <19 pg OCDD B. 2 nd toluene blank following CAL-VER must have <0.2 pg TCDD and <3 pg OCDD $<10\%$ contribution from preceding sample (based on observed instrument carryover rate)
Analyte/Surrogate Ratios	Response must be within the calibrated range of the instrument. Coders may use data from more than one chromatogram to get the responses in the calibrated range.
Ion Ratios	Must be within $\pm 15\%$ of theoretical
Sensitivity	S:N $\geq 10:1$ for all compounds for 0.1 pg/ μ L (CS-0.2), plus For bloods: S:N $\geq 3:1$ for 0.025 pg/ μ L 2,3,7,8-T4CDD

¹ Duplicate criterion is a guideline; final assessment depends upon sample characteristics, overall batch QC and on-going lab performance.

**Analysis of PCB Congeners
By USEPA Method 1668A**

Samples are spiked with isotopically labelled surrogate standards, solvent extracted and cleaned up on a series of chromatographic columns which may include silica, Florisil, alumina, carbon/Celite and gel permeation columns. The final extract is spiked with isotopically labelled recovery (internal) standards prior to instrumental analysis. Analysis of the extract is performed on high-resolution mass spectrometer (HRMS) coupled to a high-resolution gas chromatograph (HRGC) equipped with a SPB-Octyl chromatography column (30 m, 0.25 mm i.d., 0.25 µm film thickness). Resolution of the PCB 156/157 coelution may be achieved by high resolution GC/MS using a DB-1 chromatography column (30 m, 0.25 mm id, 0.25 µm film thickness). The method is carried out in accordance with the protocols described in EPA Method 1668A *with changes and correction through to August 20, 2003*, incorporating the AXYS modifications described below. Details of all procedures are documented in AXYS method MLA-010, *Analytical Method for Determination of 209 PCB Congeners by EPA Method 1668A*.

Method Modifications:

Section 4.2.1, 4.2.2: The protocol for washing reusable glassware includes a detergent wash, water rinse and baking at a minimum of 300°C for 8 hours. Immediately prior to use, glassware is solvent rinsed with toluene and hexane.

Section 4.7: The first cleanup column for tissue extracts is a gravity gel permeation column (SX-3 Biobeads). An anthropogenic isolation column 7.5.3 is not used.

Section 6.5.1: Glass wool is cleaned by rinsing twice with toluene and twice with hexane.

Section 7.12, 7.13, 9.0, 11.0: The concentration of the labeled toxics/LOC and the cleanup standard spiking solutions is 100 ng/mL and the sample spiking volume is 20 µL. The resulting final concentrations in the extracts are as specified in the method.

Section 7.14: Concentration of the labeled injection internal standard spiking solution (recovery standard) is modified so that a volume of 5 µL is added. The resulting amount of standard added to the final extract is the same as specified in the method. The solution is spiked into a 15 µL extract volume for a final extract volume of 20 µL.

Section 7.2.1: Powdered, not granular, sodium sulphate is baked at a minimum of 300°C for 8 hrs rather than at 600°C for 24 hrs.

Section 7.5.1: Silica is activated by baking at 450°C in a muffle oven for at least 8 hrs.

Section 7.5.4.1.1: Florisil is baked at 450°C in a muffle over for at least 8 hrs, and then deactivated with water to 2.1% deactivation.

Section 10.3.3, 15.3.3: A S:N ratio of 3:1 for di-PCBS and nona-PCBs in CS0.2 calibration solution is acceptable.

Section 11.5.6: Unless requested by the client, the aqueous portion after filtration of aqueous samples with >1% solids is not discarded but is extracted.

Section 11.5, 11.5.2, 11.5.5 12.3 Solid samples are dried by mixing with anhydrous sodium sulphate. The dried solid is extracted using a soxhlet extraction apparatus. The surrogate

spike is incorporated after the drying step. Equilibration time is 30 minutes. The extracting solvent for solids is dichloromethane.

Section 11.8, 12.4: The surrogate spike is incorporated into the sample after the drying step to eliminate the possibility of disproportional loss of volatile labeled and target compounds.

Section 12.4.2: The pre-cleaning of the soxhlet apparatus is carried out using toluene instead of dichloromethane.

Section 12.4.9: Lipid analysis is carried out by sub-sampling two 2g portions of the extract from a total 30 g extract weight. The cleanup standard is spiked into the extract after soxhlet extraction and before any lipid analysis or rotary evaporation is done. The percent recoveries are corrected for the amount of extract used for lipid analysis.

Section 12.6.1.1: Rotary evaporation is done at 30°C. Daily cleaning of the rotary evaporators include dismantling and rinsing/soaking in solvent. Mimic proofs are run periodically but are not archived daily.

Section 12.7.4: Before Florisil or alumina cleanup procedures, a solvent exchange is done by reducing under nitrogen to 300 uL and bulking up to 1mL in hexane. If toluene is present the extract is reduced to 50 uL under nitrogen and bulked up to 1mL.

Section 12.7.7: Toluene (1 mL) is added to the eluate from the final column prior to rotary evaporation and nitrogen blow down concentration steps.

Section 13.1.1: GPC chromatography, by a gravity column, is routinely used only for tissue extracts. The GPC cleanup is optional for all other matrices.

Section 13.3.1: Routine layered silica column is as follows: 0.5 g neutral silica, 2 g 28% basic silica, 0.5 g neutral silica, 4 g 44% acidic silica, 4 g 22% acidic silica, 1 g neutral silica.

Section 13.3.4: The sample is loaded onto the column followed by 2-3 rinses of a least 1 mL, and eluted with 100 mL of hexane.

Section 14.2: The volume of labeled injection internal standard (recovery standard) added to the extract is 5 µL, for a final extract volume of 20 µL. Hexane rather than nonane is used as the solvent to bring extract back to volume for re-analysis or to dilute extracts.

Section 15.3: The calibration solution containing all 209 PCB congeners is used as the CAL/VER solution.

Section 17.5: Extracts are diluted with hexane. The concentration of the labeled injection internal (recovery) standard is not re-adjusted to 100 pg/uL when dilutions are performed.

Section 17.0

Conc_i - the concentrations of target analytes, and the labelled compound concentrations and recoveries, are calculated using the equations below. These procedures are equivalent to those described in the method but are more direct.

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$$Conc_i = \frac{A_i}{A_{si}} \times \frac{M_{si}}{RRF_{i,si}} \times \frac{1}{M_x}$$

- where A_i = summed areas of the primary and secondary m/z's for the analyte peak of interest (compound i)
- A_{si} = summed areas of the primary and secondary m/z's for the labelled surrogate peak used to quantify i)
- M_x = mass of sample taken for analysis
- M_{si} = mass of labelled surrogate (compound si) added to sample as calculated by the concentration of standard spiked (pg/mL) multiplied by the volume spiked (mL)
- $RRF_{i,si}$ = mean relative response factor of i to si from the five-point calibration range and defined individually as:

$$\frac{A_i}{A_{si}} \times \frac{M_{si}}{M_i}$$

Calculation of Surrogate Standard Concentrations and Percent Recoveries:
Concentrations of surrogate standards are calculated using the following equation:

$$Conc_{si} = \frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{RRF_{si,rs}}$$

and, the percent recoveries of the surrogate standards are calculated using the following equation:

$$\% Recovery = \frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{RRF_{si,rs}} \times \frac{1}{M_{si}} \times 100$$

where A_{rs} and A_{si} are the summed peak areas (from the primary and secondary m/z channels) of recovery standard and labelled surrogate added to the sample;
 M_{rs} and M_{si} are the masses of recovery standard and labelled surrogate added to the sample, and;
 $RRF_{si,rs}$ is the mean relative response factor of the labelled surrogate to the recovery standard as determined by the five-point calibration range and defined individually as:

$$\frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{M_{si}}$$

Table 1. QC Acceptance Criteria for PCBs in CAL/VER, IPR, OPR, and Samples¹

Congener	Cong. No. ²	Test conc ng/mL	CAL/VER ⁴ (%)		IPR ⁵ (%)		OPR ⁶ (%)		Labelled compound recovery in samples	
			Warning Limit	Acceptance Limit	RSD	X	Warning Limit	Acceptance Limit (%)	Warning Limit	Acceptance Limit
2-MoCB	1	50	75-125	70-130	40	60-140	70-130	50-150	-	-
4-MoCB	3	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2'-DiCB	4	50	75-125	70-130	40	60-140	70-130	50-150	-	-
4,4'-DiCB	15	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2'-TrCB	19	50	75-125	70-130	40	60-140	70-130	50-150	-	-
3,4,4'-TrCB	37	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',6'-TeCB	54	50	75-125	70-130	40	60-140	70-130	50-150	-	-
3,3',4,4'-TeCB	77	50	75-125	70-130	40	60-140	70-130	50-150	-	-
3,4,4',5'-TeCB	81	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',4,6,6'-PeCB	104	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3,3',4,4'-PeCB	105	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3,4,4',5'-PeCB	114	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3',4,4',5'-PeCB	118	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2',3,4,4',5'-PeCB	123	50	75-125	70-130	40	60-140	70-130	50-150	-	-
3,3',4,4',5'-PeCB	126	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',4,4',6,6'-HxCB	155	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3,3',4,4',5'-HxCB ³	156	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3,3',4,4',5'-HxCB ³	157	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3',4,4',5,5'-HxCB	167	50	75-125	70-130	40	60-140	70-130	50-150	-	-
3,3',4,4',5,5'-HxCB	169	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',3,4',5,6,6'-HpCB	188	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3,3',4,4',5,5'-HpCB	189	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',3,3',5,5',6'-OoCB	202	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,3,3',4,4',5,5',6'-OoCB	205	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',3,3',4,4',5,5',6'-NoCB	206	50	75-125	70-130	40	60-140	70-130	50-150	-	-
2,2',3,3',4,4',5,5',6'-NoCB	208	50	75-125	70-130	40	60-140	70-130	50-150	-	-
DeCB	209	50	75-125	70-130	40	60-140	70-130	50-150	-	-
Labelled Compounds										
¹³ C ₁₂ -2-MoCB	1L	100	65-135	50-150	50	20-135	15-140	15-140	15-130	15-150
¹³ C ₁₂ -4-MoCB	3L	100	65-135	50-150	50	20-135	15-140	15-140	15-130	15-150
¹³ C ₁₂ -2,2'-DiCB	4L	100	65-135	50-150	50	35-135	30-140	30-140	25-130	25-150
¹³ C ₁₂ -4,4'-DiCB	15L	100	65-135	50-150	50	35-135	30-140	30-140	25-130	25-150
¹³ C ₁₂ -2,2',6'-TrCB	19L	100	65-135	50-150	50	35-135	30-140	30-140	30-130	25-150
¹³ C ₁₂ -3,4,4'-TrCB	37L	100	65-135	50-150	50	35-135	30-140	30-140	30-130	25-150
¹³ C ₁₂ -2,2',6,6'-TeCB	54L	100	65-135	50-150	50	35-135	30-140	30-140	30-130	25-150
¹³ C ₁₂ -3,3',4,4'-TCB	77L	100	65-135	50-150	50	35-135	30-140	30-140	30-130	25-150
¹³ C ₁₂ -3,4,4',5'-TeCB	81L	100	65-135	50-150	50	35-135	30-140	30-140	30-130	25-150
¹³ C ₁₂ -2,2',4,6,6'-PeCB	104L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3,3',4,4'-PeCB	105L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3,4,4',5'-PeCB	114L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3',4,4',5'-PeCB	118L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2',3,4,4',5'-PeCB	123L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -3,3',4,4',5'-PeCB	126L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,2',4,4',6,6'-HxCB	155L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3,3',4,4',5'-HxCB ³	156L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3,3',4,4',5'-HxCB ³	157L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3',4,4',5,5'-HxCB	167L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -3,3',4,4',5,5'-HxCB	169L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,2',3,4',5,6,6'-HpCB	188L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2',3,3',4,4',5,5'-HpCB	189L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,2',3,3',5,5',6'-OoCB	202L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,3,3',4,4',5,5',6'-OoCB	205L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6'-NoCB	206L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6'-NoCB	208L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6'-DeCB	209L	100	65-135	50-150	50	35-135	30-140	30-140	40-130	25-150
Cleanup Standard										
¹³ C ₁₂ -2,4,4'-TriCB	28L	100	60-130	60-130	45	45-120	40-125	40-125	40-130	30-135
¹³ C ₁₂ -2,3,3',5,5'-PeCB	111L	100	60-130	60-130	45	45-120	40-125	40-125	40-130	30-135
¹³ C ₁₂ -2,2',3,3',5,5',6'-HpCB	178L	100	60-130	60-130	45	45-120	40-125	40-125	40-130	30-135

1. QC acceptance criteria for IPR, OPR, and samples based on a 20 µL extract final volume

2. Suffix "L" indicates labelled compound.

3. PCBs 156 and 157 are tested as the sum of two concentrations

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4. CAL VER: Calibration Verification test run at least every 12 hours
5. IPR: Initial Precision and Recovery demonstration
6. OPR: Ongoing Precision and Recovery test run with every batch of samples.

Table 1 con't

QC Parameter	Specification
Analysis Duplicate	Must agree to within $\pm 20\%$ of the mean (applicable to concentrations >10 times the DL) ¹
Procedural Blank	Analyte concentrations in blank samples for PCB congeners 77, 81, 114, 123, 126 and 169 must be less than 2 pg/congener/sample, and concentrations of PCB congeners 156, 157, 167 and 189 must be less than 10 pg/congener/sample. Concentrations of all other individual PCB congeners or coelutions must be less than 50 pg/congener/sample in blank samples. The sum of all 209 congeners must be less than 300 pg/sample. Higher levels are acceptable where sample concentrations exceed 10x the blank levels.
Detection Limit	Typical sample specific detection limits for individual congeners, determined from chromatographic noise, range from 0.5 to 2.0 pg.
Initial Calibration	For 6-point calibration, a relative standard deviation of the RRF's $\leq 20\%$ for all compounds. Ion ratios for all congeners must be within $\pm 15\%$ of theoretical for CS 0.2. Minimum S:N ratio 10:1 for all calibration standards, except for CS0.2, where the S:N may be as low as 3:1 for di-PCBs and nona-PCBs.
Analyte/Surrogate Ratios	Response must be within the calibrated range of the instrument. Coders may use data from more than one chromatogram to get the responses in the calibrated range.
Ion Ratios	Ion ratios must fall within $\pm 15\%$ of the theoretical values for positive identification of all targets in the calibration standards and samples.
Sensitivity	Minimum S:N ratio 10:1 for all calibration standards except for CS0.2, where the S:N may be as low as 3:1 for di-PCBs and nona-PCBs.

¹. Duplicate criterion is a guideline, final assessment depends upon sample characteristics, overall batch QC and on-going lab performance.

DETERMINATION OF ORGANOCHLORINE PESTICIDES BY HRGC/HRMS

Extraction and Cleanup Procedures

This method is applicable to the analysis of solids, tissues (including milk and blood), aqueous samples, XAD columns, air samples and solvent extracts. Samples are spiked with a suite of isotopically labelled surrogate standards before extraction. Water is extracted by shaking with dichloromethane. Solids, XAD-2 columns and tissue are Soxhlet extracted with dichloromethane. Filters are extracted with toluene in a Dean-Stark modified Soxhlet extractor. Milk and blood are extracted into hexane. Gel permeation chromatography is performed on some sample extracts. The extracts are cleaned up and separated into two fractions, E1 and E2, using Florisil. Each fraction is spiked with isotopically labelled recovery (internal) standard(s) and analysed for a suite of organochlorine pesticides by high-resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS).

HRGC/HRMS Analysis

Instrumental analysis of the E1 and E2 fractions is performed on a high-resolution gas chromatograph (HRGC) equipped with a J&W DB-5 chromatography column (60 m, 0.25 mm i.d., 0.10 µm film thickness) coupled to a high-resolution mass spectrometer (HRMS). The HRMS is operated at a static (8000) mass resolution (10% valley) in the electron ionization (EI) mode using multiple ion detection (MID). The ions acquired are presented in Tables 1 and 2.

Initial calibration is performed using a multi-point calibration series of solutions that encompass the working concentration range. Calibration is verified at least once every twelve hours by analysis of a mid-level calibration solution.

Analyte Identification

A chromatographic peak is identified as a target compound if the following criteria are met for the quantification and confirmation ions (where confirmation ions are available):

1. Peak responses must be at least three times the background noise level.
2. The relative retention time must be within the window predicted from the initial calibration runs and the surrogate standard retention times.
3. Peak maxima for quantification and confirmation ions must coincide within two seconds.
4. The relative ion abundance ratios must be within 20% of the theoretical, except for labelled oxychlordane and labelled methoxychlor, that must be within 30% and 50% respectively.

Quantification Procedures

Target concentrations are determined with respect to labelled surrogate standards as shown in Tables 1 and 2. Mean relative response factors (RRF) determined from the initial calibration runs are used to convert raw peak areas in sample chromatograms to final concentrations as follows:

$$\text{Concentration of target} = \left(\frac{\text{area of Target}}{\text{area of Surrogate}} \right) \times \left(\frac{\text{weight of Surrogate}}{\text{weight of Sample}} \right) \times \left(\frac{1}{\text{RRF}} \right)$$

$$\text{where RRF} = \left(\frac{\text{area of Target}}{\text{area of Surrogate}} \right) \times \left(\frac{\text{concentration of Surrogate}}{\text{concentration of Target}} \right)$$

Final concentrations are recovery corrected by the method of quantification.

Sample specific detection limits (SDLs) reported with the analytical results are determined from the analysis data by converting the minimum detectable signal to a concentration following the same procedures used to convert target peak responses to concentrations. The estimated minimum detectable area is determined as three times the height of the noise in the m/z channel of interest, converted to an area using the area height ratio of the corresponding labelled surrogate peak.

Recoveries of surrogates are determined similarly against the recovery (internal) standard and are used as general indicators of overall analytical quality.

QA/QC

Samples are analyzed in batches consisting of a maximum of twenty samples, one procedural blank and one spiked matrix (OPR) sample. Sample duplicates or matrix spike/matrix spike duplicate (MS/MSD) pairs may be analyzed on an individual contract basis. The batch is carried through the complete analytical process as a unit. For sample data to be reportable, the batch QC data must meet the established acceptance criteria presented on the analysis reports.

All aspects of the method are described in detail in AXYS' document MLA-028 "Analytical Procedures for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS".

Table 1. Analyte Ions Monitored, Surrogates Used, and RRF Determination for E1 Pesticides by HR GC/MS

(No entry in the "RRF Used" field designates an RRF derived from that same compound.)

Analyte Name	Quantified against labelled standard	RRF Determination	Typical Retention Time	RT Win. (sec)	Acquired in Function	mass1	mass2	m1/m2 ratio	Ion Ratio Tolerance (+/- %)
1,3/1,4-Cl ₂ -BZ	¹³ C ₆ -1,4-Cl ₂ -BZ		9:11	10	1	145.969	147.966	1.56	20
1,2-Cl ₂ -BZ	¹³ C ₆ -1,4-Cl ₂ -BZ		9:31	10	1	145.969	147.966	1.56	20
1,3,5-Cl ₃ -BZ	¹³ C ₆ -1,2,3-Cl ₃ -BZ		11:04	10	1	179.93	181.927	1.03	20
1,2,4-Cl ₃ -BZ	¹³ C ₆ -1,2,3-Cl ₃ -BZ		11:47	10	1	179.93	181.927	1.03	20
1,2,3-Cl ₃ -BZ	¹³ C ₆ -1,2,3-Cl ₃ -BZ		12:21	10	1	179.93	181.927	1.03	20
1,2,4,5/3,5-Cl ₄ -BZ	¹³ C ₆ -1,2,3,4-Cl ₄ -BZ		14:14	10	2	213.891	215.888	0.77	20
1,2,3,4-Cl ₄ -BZ	¹³ C ₆ -1,2,3,4-Cl ₄ -BZ		15:02	10	2	213.891	215.888	0.77	20
Cl ₅ -BZ	¹³ C ₆ -Cl ₅ -BZ		17:27	10	2	247.852	249.849	0.62	20
HCB	¹³ C ₆ -HCB		20:55	10	3	283.81	285.807	1.25	20
TCMX	¹³ C ₆ -HCB		19:06	15	2	241.922	243.919	0.78	20
Cl ₆ -Butadiene	¹³ C ₆ -1,2,3,4-Cl ₄ -BZ	1,2,3,4-Cl ₄ -BZ	12:20	15	1	189.872	187.875	1.32	20
alpha-HCH	¹³ C ₆ -gamma-HCH		20:36	10	3	216.915	218.912	0.77	20
beta-HCH	¹³ C ₆ -beta-HCH		21:39	10	3	216.915	218.912	0.77	20
gamma-HCH	¹³ C ₆ -gamma-HCH		21:48	10	3	216.915	218.912	0.77	20
delta-HCH ¹	¹³ C ₆ -delta-HCH		22:43	10	3	216.915	218.912	0.77	20
Heptachlor	¹³ C ₁₀ -Heptachlor		24:25	10	3	271.81	273.81	1.24	20
Aldrin	¹³ C ₁₂ -Aldrin		25:43	10	3	262.857	264.854	1.55	20
Octachlorostyrene	¹³ C ₁₀ -trans-Chlordane		27:05	10	3	270.844	272.841	0.62	20
Oxychlordane	¹³ C ₁₀ -Oxychlordane		27:16	10	3	262.857	264.854	1.55	20
trans-Chlordane	¹³ C ₁₀ -trans-Chlordane		28:06	10	4	271.81	273.807	1.24	20
cis-Chlordane	¹³ C ₁₀ -trans-Chlordane		28:41	10	4	271.81	273.807	1.24	20
o,p-DDE	¹³ C ₁₂ -o,p-DDE		28:19	10	4	246	247.997	1.56	20
p,p-DDE	¹³ C ₁₂ -p,p-DDE		29:29	10	4	246	247.997	1.56	20
trans-Nonachlor	¹³ C ₁₀ -trans-Nonachlor		28:52	10	4	271.81	273.807	1.24	20
cis-Nonachlor	¹³ C ₁₀ -cis-Nonachlor		31:12	10	5	271.81	273.807	1.24	20
o,p-DDD	¹³ C ₁₂ -o,p-DDT		29:49	10	5	235.008	237.005	1.56	20
p,p-DDD	¹³ C ₁₂ -o,p-DDT		31:03	10	5	235.008	237.005	1.56	20
o,p-DDT	¹³ C ₁₂ -o,p-DDT		31:10	10	5	235.008	237.005	1.56	20
p,p-DDT	¹³ C ₁₂ -p,p-DDT		32:24	10	5	235.008	237.005	1.56	20
Mirex	¹³ C ₁₀ -Mirex		34:54	10	5	269.813	271.81	0.52	20

¹ delta-HCH normally will elute primarily in the E2 fraction and can be quantified solely from this fraction. Recoveries of ¹³C-delta-HCH may be reported as the sum of the E1 and E2 recoveries if significant concentrations of ¹³C-delta-HCH are observed in the E1 fraction.

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Table 1 (Cont'd)

Analyte Name	Quantified against labelled standard	RRF Determination	Typical Retention Time	RT Win. (sec)	Acquired in Function	mass1	mass2	m1/m2 ratio	Ion Ratio Tolerance (+/-)
¹³ C ₆ -1,4-Cl ₂ -BZ	¹³ C ₁₂ -PCB-52		9:10	30	1	151.989	153.986	1.56	20
¹³ C ₆ -1,2,3-Cl ₃ -BZ	¹³ C ₁₂ -PCB-52		12:20	30	1	185.95	187.947	1.03	20
¹³ C ₆ -1,2,3,4-Cl ₄ -BZ	¹³ C ₁₂ -PCB-52		15:02	30	2	221.908	223.905	2.08	20
¹³ C ₆ -Cl ₅ -BZ	¹³ C ₁₂ -PCB-52		17:26	30	2	255.869	257.866	1.55	20
¹³ C ₆ -HCB	¹³ C ₁₂ -PCB-52		20:55	30	3	289.83	291.828	1.25	20
¹³ C ₆ -beta-HCH	¹³ C ₁₂ -PCB-52		21:38	30	3	222.935	224.932	0.77	20
¹³ C ₆ -gamma-HCH	¹³ C ₁₂ -PCB-52		21:47	30	3	222.935	224.932	0.77	20
¹³ C ₆ -delta-HCH	¹³ C ₁₂ -PCB-52		22:42	30	3	222.935	224.932	0.77	20
¹³ C ₁₀ -Heptachlor	¹³ C ₁₂ -PCB-52		24:24	30	3	276.827	278.824	1.24	20
¹³ C ₁₀ -Aldrin	¹³ C ₁₂ -PCB-52		25:41	30	3	269.88	271.877	1.55	20
¹³ C ₁₀ -Oxychlordane	¹³ C ₁₂ -PCB-52		27:15	30	3	269.88	271.877	1.55	30
¹³ C ₁₀ -trans-Chlordane	¹³ C ₁₂ -PCB-138		28:05	30	4	276.827	278.824	1.24	20
¹³ C ₁₀ -trans-Nonachlor	¹³ C ₁₂ -PCB-138		28:51	30	4	276.827	278.824	1.24	20
¹³ C ₁₀ -cis-Nonachlor	¹³ C ₁₂ -PCB-138		31:11	30	5	276.827	278.824	1.24	20
¹³ C ₁₂ -o,p-DDE	¹³ C ₁₂ -PCB-138		28:18	30	4	258.041	260.038	1.56	20
¹³ C ₁₂ -p,p-DDE	¹³ C ₁₂ -PCB-138		29:29	30	4	258.041	260.038	1.56	20
¹³ C ₁₂ -o,p-DDT	¹³ C ₁₂ -PCB-138		31:09	30	5	247.048	249.045	1.56	20
¹³ C ₁₂ -p,p-DDT	¹³ C ₁₂ -PCB-138		32:23	30	5	247.048	249.045	1.56	20
¹³ C ₁₀ -Mirex	¹³ C ₁₂ -PCB-138		34:53	30	5	276.827	278.824	1.25	20
Recovery Standards									
¹³ C ₁₂ -PCB-52			25:07	100	3	301.963	303.96	0.77	20
¹³ C ₁₂ -PCB-138			32:31	100	5	299.947	301.944	0.77	20
Lock-Mass					1	180.989			
Lock-Mass					1	180.989			
Lock-Mass					2	230.986			
Lock-Mass					2	230.986			
Lock-Mass					3	230.986			
Lock-Mass					3	230.986			
Lock-Mass					3	230.986			
Lock-Mass					3	230.986			
Lock-Mass					4	292.982			
Lock-Mass					4	292.982			
Lock-Mass					5	292.982			
Lock-Mass					5	292.982			
Lock-Mass					5	292.982			
Lock-Mass					5	292.982			
Lock-Mass					3	230.986			
Lock-Mass					5	292.982			

Table 2. Analyte Ions Monitored, Surrogates Used and RRF Determination for E2 Pesticides by GC/MS

(No entry in the "RRF Used" field designates an RRF derived from that same compound.)

Analyte Name	Quantified against labelled standard	RRF Determination	Typical Retention Time	RT Win. (sec)	Acquired in Function	mass1	mass2	m1/m2 ratio	Ion Ratio Tolerance (+/- %)
delta-HCH	¹³ C ₆ -gamma-HCH		13:13	10	1	216.915	220.909	1.63	20
Heptachlor epoxide	¹³ C ₉ -Heptachlor-Epoxide		18:31	10	2	354.841	352.844	0.8	20
alpha-Endosulphan	¹³ C ₉ -alpha-endosulphan		20:59	10	2	264.854	262.857	0.64	20
Dieldrin	¹³ C ₁₂ -Dieldrin		23:00	10	2	264.854	262.857	0.64	20
Endrin	¹³ C ₁₂ -Endrin		24:22	10	2	264.854	262.857	0.64	20
beta-Endosulphan	¹³ C ₉ -beta-Endosulphan		24:55	10	2	264.854	262.857	0.64	20
Endosulphan sulphate	¹³ C ₉ -beta-Endosulphan		27:06	10	2	264.854	262.857	0.64	20
Endrin aldehyde	¹³ C ₁₂ -Endrin		25:56	10	2	346.896	344.899	0.64	20
Endrin ketone	¹³ C ₁₂ -Endrin		29:00	10	2	318.901	316.904	0.64	20
Methoxychlor	¹³ C ₁₂ -Methoxychlor		29:45	10	3	228.111	227.107	Note 1	20
Labelled Surrogates									
¹³ C ₆ -gamma-HCH	¹³ C ₁₂ -PCB-153		13:12	40	1	222.935	224.932	0.78	20
¹³ C ₉ -Heptachlor-Epoxide	¹³ C ₁₂ -PCB-153		18:30	30	2	364.875	362.878	0.8	20
¹³ C ₉ -alpha-endosulphan	¹³ C ₁₂ -PCB-153		20:58	30	2	271.877	269.88	0.64	20
¹³ C ₁₂ -Dieldrin	¹³ C ₁₂ -PCB-153		22:58	30	2	271.877	269.88	0.64	20
¹³ C ₁₂ -Endrin	¹³ C ₁₂ -PCB-153		24:20	30	2	271.877	269.88	0.64	20
¹³ C ₉ -beta-Endosulphan	¹³ C ₁₂ -PCB-153		24:55	30	2	271.877	269.88	0.64	20
¹³ C ₁₂ -Methoxychlor	¹³ C ₁₂ -PCB-153		29:45	30	3	239.148	240.151	Note 1	20
Recovery Standard									
¹³ C ₁₂ -PCB-153			26:16	100	2	299.947	301.944	0.78	20
Lock Mass					1	218.986			
Lock Mass					2	292.982			
Lock Mass					2	292.982			
Lock Mass					2	292.982			
Lock Mass					2	292.982			
Lock Mass					2	292.982			
Lock Mass					3	292.982			
Lock Mass					2	292.982			
Summary Pest					2	262.857			

Note 1: Ratio is established empirically from the Daily Calibration

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH), ALKANES AND ALKYLATED PAH IN SEDIMENT, TISSUE, WATER, HEXANE EXTRACTS, XAD RESIN AND FILTER SAMPLES BY GC/MS

SUMMARY

Samples are spiked with a suite of perdeuterated PAH surrogate standards and are solvent extracted. The raw extract is fractionated on silica into polar and non-polar fractions. The polar fraction is analyzed for PAH by gas chromatography/mass spectrometry (GC/LRMS). The non-polar fraction is analyzed for Alkanes by GC/LRMS

1. EXTRACTION PROCEDURES

The extraction, cleanup and analysis procedures are fully documented in AXYS method MLA-021, "Analytical Method for the Determination of Polycyclic Aromatic Hydrocarbons (PAH), Alkylated Polycyclic Aromatic Hydrocarbons, and Alkanes".

All samples are spiked with a suite of perdeuterated surrogate standards. The surrogates used are listed in Table 1. The routine quantity of each surrogate added to each sample is 2000 ng (20 000 ng for sediment or high-level samples). The amount of surrogate required is dependent upon sample size, final extract volume, and concentrations of analytes in the sample and may be adjusted accordingly.

Tissue and solid samples are either dried with sodium sulphate and extracted by soxhlet, or base digested prior to solvent extraction. Aqueous samples are filtered prior to extraction if required, and solvent extracted. XAD-2 columns, ambient air (PUF/Filter) samples, and stack gas sample trains are extracted by soxhlet.

2. COLUMN CHROMATOGRAPHY

The extract is loaded onto a silica gel column which is eluted with pentane followed by dichloromethane. The pentane fraction contains the alkanes. The dichloromethane fraction contains the PAHs. Each fraction is concentrated to a small volume and transferred to an autosampler vial. Recovery (internal) standards (deuterated analogs of acenaphthene, pyrene, and benzo(e)pyrene) are added, in similar quantity to the surrogates, prior to GC/MS analysis. If necessary, extracts may also be cleaned up by additional column chromatography procedures to remove interferences. This may be done initially or as remedial action to reduce interferences.

3. INSTRUMENTAL ANALYSIS

Analysis of the extract is conducted using high resolution gas chromatography coupled with low resolution quadrupole mass spectrometry (HRGC/LRMS). Analysis of PAHs and Alkanes require separate analysis runs different series of calibration standards.

Sensitivity

LRMS: For 10 pg of each target analyte, the signal to noise ratio must be greater than or equal to 3:1.

GC Resolution

The valley height (expressed in terms of the smaller peak in the pair) between benzo(b)fluoranthene and benzo(k)fluoranthene must be less than or equal to 75% and the valley height between phenanthrene and anthracene must be less than or equal to 30% for all calibration runs.

Instrument Calibration

Initial calibration is performed using a series of solutions that encompass the working concentration range of the instrument. The initial calibration solutions contain the suite of labelled surrogate and recovery standards and authentic target analytes. Calibration is verified at least once every twelve hours by analysis of a mid-level calibration solution. The nominal concentration ranges of target analytes in the calibration solutions are as follows:

PAH, Alkylated PAH	50 ng/mL – 5000 ng/mL
Alkanes	100 ng/mL – 10 000 ng/mL

Quadrupole (Low Resolution) GC/MS Analysis

HRGC/LRMS analysis is conducted on a low-resolution mass spectrometer (MS) equipped with a gas chromatograph, running manufacturer's software. A Restek Rt_x-5 chromatography column (30 m, 0.25 mm i.d., 0.25 µm film thickness) is coupled directly to the MS source. The MS is operated at a unit mass resolution in the electron impact (EI) ionization mode using multiple ion detection (MID) acquiring at least one characteristic ion for each target analyte and surrogate standard. A splitless/split injection sequence is used. The ions acquired are listed in the attached Table 1.

4. ANALYTE IDENTIFICATION

A chromatographic peak is identified as a target compound if the following criteria are met for the quantification and confirmation ions (where confirmation ions are available):

1. Peak responses must be at least three times the background noise level.
2. The retention time must be within three seconds of that predicted from the calibration run and the sample retention time reference (labelled compound).
3. Peak maxima for the quantitation and confirmation ions must coincide within two seconds.
4. The relative ion abundance ratios must be within 20% of the initial calibration values for HRGC/LRMS analysis.

5. QUANTIFICATION

Target concentrations are determined with respect to the labelled surrogate standards added at the beginning of analysis, the surrogate employed is the one judged to be chemically most similar to the target analyte. Mean relative response factors (RRF) determined from the initial calibration runs are used to convert raw peak areas in sample chromatograms to final concentrations using the following formulae:

$$\text{Concentration of Target} = \left(\frac{\text{area of Target}}{\text{area of Surrogate}} \right) \times \left(\frac{\text{weight of Surrogate}}{\text{RRF}} \right) \times \left(\frac{1}{\text{weight of sample}} \right)$$

where $\text{RRF} = \left(\frac{\text{area of Target}}{\text{area of Surrogate}} \right) \times \left(\frac{\text{weight of Surrogate}}{\text{weight of Target}} \right)$

An optional quantification procedure, which uses the mean RRFs from a single calibration solution, run before and after a suite of samples, may be used.

Alkylated PAH totals are determined from peak response sums within the corresponding window.

Recoveries of surrogates are determined by the above method using the recovery (internal) compounds for quantification.

Further quantification details are given in Table 1.

In the alkane analysis, response factors are determined only for pristane and alkanes with an even number of carbon atoms. These response factors are used to calculate response factors for the other alkanes, as summarized in Table 2.

6. QUALITY ACCEPTANCE CRITERIA

- Samples are analyzed in batches consisting of a maximum of twenty samples, a procedural blank, a spiked reference sample and a duplicate sample. Matrix spike/matrix spike duplicate (MS/MSD) pairs may be substituted for duplicates on an individual contract basis. Each batch is carried through the complete analytical process as a unit. For sample data to be reportable the batch QC data must meet established acceptance criteria.
- For the initial multi-level calibration the percent relative standard deviation (%RSD) of the RRFs must be less than 20% for analytes with labelled surrogates and less than 35% for others. The concentration of analytes from the opening calibration verification runs must be within 25% of the means from the initial calibration. Concentrations of native compounds in the closing calibration verification must be within $\pm 25\%$ of expected values. Concentrations of labelled surrogates in the closing calibration must be within $\pm 25\%$ of expected values, with any two (2) values allowed to be within $\pm 40\%$. Initial calibration is repeated as necessary to maintain this agreement.
- For a single point calibration, the RSD of concentrations of native compounds must agree to $\pm 20\%$ for targets with a labelled analog present over a 12-hour period. RSD of concentrations of labelled must agree to $\pm 35\%$ of expected values over a 12-hour period.
- Concentrations of target analytes in procedural blanks must be < 10 ng absolute for naphthalene and phenanthrene, < 5 ng for all others, or 5 times lower than analogous analyte value detected in the samples.
- Recoveries of target compounds in reference samples must fall within 70-130% for all targets except acenaphthylene, which is 70-140%.
- Percent recoveries of surrogate compounds must fall within established acceptance limits. These are generally in the range of 15-120% for naphthalene and 20-120% for

acenaphthylene, and methylnaphthalene. Recoveries of all other surrogates must be in the range of 30-120%. It should be noted that surrogate recoveries are reported only as indicators of overall method performance since the method of quantification yields recovery corrected concentrations.

- The difference between target concentrations for duplicate (or MS/MSD) samples must be less than 40%.

PAHs and Hydrocarbons

Table 1. Analyte Ions Monitored, Surrogates Used and RRF Determination For PAH by Low Resolution GC/MS

Compound	Quantification Ion (m/z)	Confirmation Ions (m/z)	SURROGATE	RRF DETERMINED FROM
Naphthalene	128	102	d ₈ -Naphthalene	Naphthalene
Acenaphthylene	152	151	d ₈ -Acenaphthylene	Acenaphthylene
Acenaphthene	154	153	d ₈ -Acenaphthylene	Acenaphthene
Fluorene	166	165	d ₁₀ -Phenanthrene	Fluorene
Phenanthrene	178	176	d ₁₀ -Phenanthrene	Phenanthrene
Anthracene	178	176	d ₁₀ -Phenanthrene	Anthracene
Fluoranthene	202	200	d ₁₀ -Fluoranthene	Fluoranthene
Pyrene	202	200	d ₁₀ -Fluoranthene	Pyrene
Benz[a]anthracene	228	226	d ₁₂ -Benz[a]anthracene	Benz[a]anthracene
Chrysene ¹	228	226	d ₁₂ -Chrysene	Chrysene
Benzo[b,k]fluoranthene	252	253	d ₁₂ -Benzo[b,k]fluoranthene	Benzo[b,k]fluoranthene
Benzo[e]pyrene	252	253	d ₁₂ -Benzo[a]pyrene	Benzo[e]pyrene
Benzo[a]pyrene	252	253	d ₁₂ -Benzo[a]pyrene	Benzo[a]pyrene
Perylene	252	253	d ₁₂ -Perylene	Perylene
Dibenzo[ah]anthracene ²	278	139	d ₁₄ -Dibenzo[ah]anthracene	Dibenz[ah]anthracene
Indeno[1,2,3-cd]pyrene	276	138	d ₁₂ -Indeno[1,2,3,cd]pyrene	Indeno[1,2,3-cd]pyrene
Benzo[ghi]perylene	276	138	d ₁₂ -Benzo[ghi]perylene	Benzo[ghi]perylene
1-Methylnaphthalene ³	142	141	d ₁₀ -2-Methylnaphthalene	1-Methylnaphthalene
2-Methylnaphthalene ³	142	141	d ₁₀ -2-Methylnaphthalene	2-Methylnaphthalene
C1-Naphthalenes ³	142	141	d ₁₀ -2-Methylnaphthalene	1- / 2-Methylnaphthalene
2,6-Dimethylnaphthalene ³	156	141	d ₁₂ -2,6 Dimethylnaphthalene	2,6-Dimethylnaphthalene
C2-Naphthalenes ³	156	141	d ₁₂ -2,6 Dimethylnaphthalene	2,6-Dimethylnaphthalene
2,3,5-Trimethylnaphthalene ³	170	155	d ₁₂ -2,6 Dimethylnaphthalene	2,3,5- Trimethylnaphthalene
C3-Naphthalenes ³	170	155	d ₁₂ -2,6 Dimethylnaphthalene	2,3,5- Trimethylnaphthalene
1-Methylphenanthrene ³	192	191	d ₁₀ -Phenanthrene	1-Methylphenanthrene
C1-Phenanthrenes/Anthracenes ³	192	191	d ₁₀ -Phenanthrene	1-Methylphenanthrene
3,6-Dimethylphenanthrene ³	206	191	d ₁₀ -Phenanthrene	3,6-Dimethylphenanthrene
C2-Phenanthrenes/Anthracenes ³	206	191	d ₁₀ -Phenanthrene	3,6-Dimethylphenanthrene
Dibenzothiophene ³	184	152	d ₁₀ -Phenanthrene	Dibenzothiophene
Retene ³	234	219	d ₁₀ -Fluoranthene	Retene
Biphenyl ³	154	152	d ₁₀ -2-Methylnaphthalene	Biphenyl
LABELLED SURROGATE STANDARDS	Quantification Ion (m/z)	Confirmation Ions (m/z)	RECOVERY CALCULATED AGAINST	
d ₈ -Naphthalene	136	134	d ₁₀ -Acenaphthene	
d ₁₀ -2-Methylnaphthalene	152	151	d ₁₀ -Acenaphthene	
d ₈ -Acenaphthylene	160	158	d ₁₀ -Acenaphthene	
d ₁₀ -Phenanthrene	188	184	d ₁₀ -Pyrene	
d ₁₀ -Fluoranthene	212	208	d ₁₀ -Pyrene	
d ₁₂ -Benz[a]anthracene	240	236	d ₁₀ -Pyrene	
d ₁₂ -Chrysene	240	236	d ₁₀ -Pyrene	
d ₁₂ -2,6 Dimethylnaphthalene	168	150	d ₈ -Acenaphthylene	
d ₁₂ -Benzo[b,k]fluoranthene	264	260	d ₁₂ -Benzo[e]pyrene	
d ₁₂ -Benzo[a]pyrene	264	260	d ₁₂ -Benzo[e]pyrene	

¹ Coelutes with Triphenylene

² Coelutes with Dibenz[ac]anthracene

³ These compounds are in addition to the regular suite of analytes, and are analyzed by client request only.

PAHs and Hydrocarbons

LABELLED SURROGATE STANDARDS	Quantification Ion (m/z)	Confirmation Ions (m/z)	RECOVERY CALCULATED AGAINST
d ₁₂ -Perylene	264	260	d ₁₂ -Benzo[e]pyrene
d ₁₂ -Indeno[1,2,3,cd]pyrene	288	284	d ₁₂ -Benzo[e]pyrene
d ₁₄ -Dibenzo[ah]anthracene	292	288	d ₁₂ -Benzo[e]pyrene
d ₁₂ -Benzo[ghi]perylene	288	284	d ₁₂ -Benzo[e]pyrene
d ₁₀ -Biphenyl	164		d ₈ -Acenaphthylene
LABELLED RECOVERY STANDARDS	Quantification Ion (m/z)	Confirmation Ions (m/z)	
d ₁₀ -Acenaphthene	164	160	
d ₁₀ -Pyrene	212	208	
d ₁₂ -Benzo[e]pyrene	264	260	

PAHs and Hydrocarbons

Table 2. Analyte Ions Monitored, Surrogate Used and RRF Determination for Alkanes by Low Resolution GC/MS

TARGET ANALYTES	Quantification Ion (m/z)	Confirmation Ion (m/z)	Surrogate	RRF Determined From
Decane nC10	57	71	Tetracosane nC24-d50	Decane nC10
Undecane nC11	57	-	Tetracosane nC24-d50	Mean of nC10, nC12
Dodecane nC12	57	71	Tetracosane nC24-d50	Dodecane nC12
Dimethyl Undecane	57	-	Tetracosane nC24-d50	Dodecane nC12
Norfarnesane	57	-	Tetracosane nC24-d50	Dodecane nC12
Tridecane nC13	57	-	Tetracosane nC24-d50	Mean of nC12, nC14
Farnesane	57	-	Tetracosane nC24-d50	Tetradecane nC14
Tetradecane nC14	57	71	Tetracosane nC24-d50	Tetradecane nC14
Trimethyl Tridecane	57	-	Tetracosane nC24-d50	Tetradecane nC14
Pentadecane	57	-	Tetracosane nC24-d50	Mean of nC14, nC16
Hexadecane nC16	57	71	Tetracosane nC24-d50	Hexadecane nC16
Norpristane	57	71	Tetracosane nC24-d50	Mean of nC16, Pristane
Heptadecane nC17	57	-	Tetracosane nC24-d50	Pristane
Pristane	57	-	Tetracosane nC24-d50	Pristane
Octadecane nC18	57	71	Tetracosane nC24-d50	Octadecane nC18
Phytane	57	-	Tetracosane nC24-d50	Octadecane nC18
Nonadecane nC19	57	-	Tetracosane nC24-d50	Mean of nC18, nC20
Eicosane nC20	57	71	Tetracosane nC24-d50	Eicosane nC20
Heneicosane nC21	57	-	Tetracosane nC24-d50	Mean of nC20, nC22
Docosane nC22	57	71	Tetracosane nC24-d50	Docosane nC22
Tricosane nC23	57	-	Tetracosane nC24-d50	Mean of nC22, nC24
Tetracosane nC24	57	71	Tetracosane nC24-d50	Tetracosane nC24
Pentacosane nC25	57	-	Tetracosane nC24-d50	Mean of nC24, nC26
Hexacosane nC26	57	71	Tetracosane nC24-d50	Hexacosane nC26
Heptacosane nC27	57	-	Tetracosane nC24-d50	Mean of nC26, nC28
Octacosane nC28	57	71	Tetracosane nC24-d50	Octacosane nC28
Nonacosane nC29	57	-	Tetracosane nC24-d50	Mean of nC28, nC30
triacontane nC30	57	71	Tetracosane nC24-d50	triacontane nC30
Unicontane nC31	57	-	Tetracosane nC24-d50	Mean of nC30, nC32
Ditriacontane nC32	57	71	Tetracosane nC24-d50	Ditriacontane nC32
Tritriacontane nC33	57	-	Tetracosane nC24-d50	Mean of nC32, nC34
Tetratriacontane nC34	57	71	Tetracosane nC24-d50	Tetratriacontane nC34
Pentatriacontane nC35	57	-	Tetracosane nC24-d50	Mean of nC34, nC36
Hexatriacontane nC36	57	71	Tetracosane nC24-d50	Hexatriacontane nC36
LABELLED SURROGATE STANDARD	Quantification Ion (m/z)	Confirmation Ion (m/z)	Recovery Calculated Against	
d ₅₀ -Tetracosane nC24	66	82	Fluoranthene d-10	
LABELLED RECOVERY STANDARD	Quantification Ion (m/z)	Confirmation Ion (m/z)		
d ₁₀ -Fluoranthene	212	106		

Attachment 7

Field Modification Form

**FIELD MODIFICATION FORM
LOWER PASSAIC RIVER RESTORATION PROJECT**

Date:

Document:

Activity:

Requested Modification:

Rationale:

Attachments:

Malcolm Pirnie Project Manager: _____

Malcolm Pirnie Deputy Project Manager: _____

Malcolm Pirnie Site QC Officer: _____

Attachment 8

SOP 3- Procedure to Conduct a Technical System Field Audit

Title: Procedure to Conduct a Technical System Audit (TSA)

I. Introduction

This guideline is to provide information on TSAs to be conducted for the Lower Passaic River Restoration Project.

II. Guidelines

The purpose of the TSA is to ensure that the sampling team adheres to the guidelines contained in the Work Plan, Field Sampling Plan (FSP), and Quality Assurance Project Plan (QAPP). Prior to conducting the audit, a copy of the Final Work Plan, FSP, and QAPP will be reviewed by the auditor (QC Officer or designee). During the TSA the sampling team's adherence to these guidelines will be verified and any deficiencies from the guidelines will be documented. The effect of the deficiencies will be noted, and any necessary corrective actions will be instituted.

Prior to conducting the audit, the auditor will contact the Deputy Project Manager to discuss the audit. This will ensure that the sampling team is properly prepared for the sampling event.

A. Conducting the TSA

The following procedures will be used to conduct the TSA:

- 1) The auditor will bring the following equipment/documents into the field:
 - Copy of the Final Work Plan, FSP, and QAPP, and any relevant memos, correspondence or addenda
 - Field laptop
 - TSA audit checklist
 - Digital camera
- 2) The following aspects of the sampling event will be audited:
 - QA/QC samples
 - Sampling methodologies
 - Field documentation, including photographs
 - Sample management tasks
 - Decontamination procedures

B. Corrective Action in the Field

Besides observing and reporting, the auditor is responsible for initiating steps for the start-up of corrective action procedures.

If the auditor witnesses discrepancies in the field between the Final Work Plan, FSP, and QAPP and the performance of the sampling team, the auditor has several options available for corrective action. These options are dependent upon the type of deficiencies observed.

Deficiencies observed and the corrective action taken must be documented in the auditor's log book.

- Minor Deficiencies

Minor deficiencies are problems where the impact, if any, to the data can be easily eliminated and the deficiency can be corrected or the procedure repeated to achieve the desired result. Minor deficiencies that are observed by the auditor will immediately be brought to the attention of the field team. The auditor and the field team will discuss the problem and agree upon what corrective action is necessary. This will allow for the deficiencies to be corrected immediately in the field.

- Major Deficiencies

Major deficiencies are events or procedures that substantially deviate from approved work plans, will result in increased project costs not previously approved, or will significantly impact the quality of the data.

Upon witnessing a major deficiency, the auditor will temporarily stop all related site work and will inform the field team of the problem. The auditor and field team will discuss the deficiency as well as what steps are necessary for corrective action. If the deficiency can be corrected in the field, the auditor may allow work to resume as long as all necessary corrective actions are taken. Information regarding the nature of the deficiency as well as the corrective action(s) taken will immediately be transmitted to the USACE PM, the Malcolm Pirnie Project Manager, and the Deputy Project Manager.

If the deficiency cannot be corrected in the field, a Stop-Work Order will be issued until appropriate measures can be taken to correct the problem. A written report of the major deficiencies will be prepared by the Site QC Officer and submitted to the USACE PM, the Malcolm Pirnie Project Manager, and the Deputy Project Manager. The Stop-Work Order will remain in effect until the proper corrective action(s) can be implemented.

C. Preparation of a TSA Report

The TSA report provides a means of relaying the events of a sampling episode to key personnel. These events could possibly affect the sample integrity (QA/QC) and therefore, are important to the decisions made regarding analytical data. This report will identify any deficiencies found in the field and will outline the corrective actions that were recommended/implemented to address any minor deficiencies observed. The field audit report will also recommend appropriate corrective actions for any major deficiency noted. Follow-up reports describing completed corrective actions which addressed major deficiencies will be submitted by the Project Manager to the USACE PM.

A quality control field audit report will usually contain the following information:

- Date and location of field audit
- Sample matrices witnessed
- Name of personnel conducting the sampling
- Summary of sample methodology
- Description of any infractions that occurred and the corrective actions taken
- Conclusions
- Recommendations
- Quality control field audit checklist

QUALITY CONTROL FIELD AUDIT REPORT

SUMMARY INFORMATION

1. PROJECT NAME: _____

2. PROJECT ADDRESS: _____

3. PRELIMINARY ASSESSMENT _____ RI/FS _____ RD _____ CONSTRUCTION _____
OTHER _____

4. DATE(S) OF QC FIELD AUDIT _____

5. AUDITOR'S NAME _____ PHONE _____

6. FACILITY CONTACT _____ PHONE _____

7. CONTRACTOR CONTACT _____ PHONE _____

8. PERSONNEL ON-SITE

<u>NAME</u>	<u>REPRESENTING</u>	<u>PHONE</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

9. AUDITOR'S COMMENTS

10. WEATHER CONDITIONS

SUNNY ; PARTLY SUNNY ; PARTLY CLOUDY ; CLOUDY ; RAIN ; DRIZZLE ; SNOW ; SLEET

TEMPERATURE_____

WIND SPEED_____

WIND DIRECTION_____

11. LEVEL OF PERSONNEL PROTECTION
REQUIRED IN WORK PLAN

A B C D

LEVEL OF PERSONNEL PROTECTION
ACTUALLY DONNED:

A B C D

12. FIELD SURVEY EQUIPMENT

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>CALIBRATION CHECK</u>	<u>CALIBRATION STANDARD</u>	<u>SPAN SETTING</u>
CONDUCTIVITY METER	_____	_____	_____	_____
DISSOLVED O ₂ METER	_____	_____	_____	_____
PH METER	_____	_____	_____	_____
COMBUSTIBLE GAS INDICATOR (LEL/O ₂)	_____	_____	_____	_____
FLAME IONIZATION DETECTOR (OVA)	_____	_____	_____	_____
PHOTOIONIZATION DETECTOR (HNU)	_____	_____	_____	_____
TOTAL GAS INDICATOR (CO,H ₂ S)	_____	_____	_____	_____
OTHER	_____	_____	_____	_____

OBSERVATIONS _____

13. DID THE SAMPLING TEAM TAKE PERIODIC SURVEYS OF THE AMBIENT AIR CONDITIONS?

YES NO N/A

14. DID THE SAMPLING TEAM PROVIDE A DECON ZONE DESIGNATING CLEAN AND CONTAMINATED AREAS?

YES NO N/A

15. WERE PHOTOGRAPHS TAKEN? YES NO

16. AUDITOR'S COMMENTS

MONITORING WELL SAMPLING SETUP AND EVACUATION

EVACUATION PROCEDURES

1. WELL CASING CONSTRUCTION STAINLESS STEEL TEFLON PVC OTHER _____

2. DIAMETER OF WELL CASING 2" 4" 6" OTHER _____

3. LOCKING CAPS ON THE WELLS? YES NO N/A PROTECTIVE CASING? YES NO N/A

4. METHOD UTILIZED TO DETERMINE THE STATIC WATER LEVEL

WATER LEVEL INDICATOR OTHER _____

5. REFERENCE POINT THAT THE STATIC WATER LEVEL WAS MEASURED FROM:

SURVEY POINT	TOP OF INNER CASING	TOP OF PROTECTIVE CASING	HEIGHT OF CASING ABOVE GROUND SURFACE
-----------------	------------------------	--------------------------------	---

6. WAS THE WATER LEVEL INDICATOR DECONTAMINATED ACCORDING TO STANDARD PROCEDURES BETWEEN EACH WELL?
YES NO N/A

IF NO, METHOD USED: _____

7. EVACUATION METHOD:

BAILER CENTRIFUGAL PUMP PERISTALTIC PUMP BLADDER PUMP SUBMERSIBLE PUMP

GAS DISPLACEMENT PUMP GAS LIFT PUMP OTHER _____

8. TYPE OF HOSE UTILIZED:

POLYETHYLENE TEFLON SILASTIC N/A OTHER _____

9. WAS THE HOSE DEDICATED TO EACH WELL LOCATION? YES NO N/A

IF NO, METHOD OF DECONTAMINATION _____

10. WAS THE PUMP DEDICATED TO EACH WELL LOCATION? YES NO N/A

11. WAS THE PUMP: LABORATORY DECONTAMINATED? FIELD DECONTAMINATED? N/A

12. WAS THE PUMP DECONTAMINATED ACCORDING TO STANDARD PROCEDURES?

YES NO IF NO, METHOD OF DECONTAMINATION _____

13. WAS THE PUMP HEAD OR END OF HOSE WITHIN 6 FEET OF THE DYNAMIC WATER LEVEL DURING EVACUATION?
YES NO N/A

14. WAS THE DECONTAMINATION AREA LOCATED AWAY FROM THE SOURCE OF CONTAMINATION?

YES NO N/A

15. AUDITOR'S COMMENTS

AQUEOUS SAMPLING PROCEDURES

1. AQUEOUS MATRIX SAMPLED:

POTABLE WELL GROUND WATER SURFACE WATER LEACHATE RUNOFF STORM SEWER
SANITARY SEWER OTHER _____

2. TYPE OF SAMPLE: GRAB COMPOSITE IF COMPOSITE - SAMPLES/COMPOSITE _____

3. WAS THE VOA SAMPLE COLLECTED FIRST? YES NO N/A

4. TYPE OF SAMPLING EQUIPMENT:

	MATERIAL OF CONSTRUCTION			
	STAINLESS STEEL	TEFLON	GLASS	OTHER
BAILER	_____	_____	_____	_____
BLADDER PUMP	_____	_____	_____	_____
SAMPLER	_____	_____	_____	_____
COLIWASA	_____	_____	_____	_____
KEMMERER DEPTH SAMPLER	_____	_____	_____	_____
WHEATON DIP SAMPLER	_____	_____	_____	_____
TUB SAMPLER	_____	_____	_____	_____
BACON BOMB	_____	_____	_____	_____

5. TYPE OF LEADER LINE THAT COMES IN CONTACT WITH THE WELL WATER:

TEFLON TEFLON COATED STAINLESS STEEL N/A OTHER _____

6. LENGTH OF THE LEADER LINE _____

7. WAS THE SAMPLING EQUIPMENT DEDICATED? YES _____ NO _____

8. WAS THE SAMPLING EQUIPMENT: LAB DECONTAMINATED? FIELD DECONTAMINATED?

9. WAS THE SAMPLING EQUIPMENT DECONTAMINATED ACCORDING TO STANDARD PROCEDURES?

YES NO IF NO, METHOD OF DECONTAMINATION: _____

10. WAS THE DECONTAMINATION AREA LOCATED AWAY FROM THE SOURCE OF CONTAMINATION?

YES NO

11. ARE DISPOSABLE GLOVES WORN AND CHANGED BETWEEN EACH SAMPLE LOCATION? YES NO

12. AUDITOR'S COMMENTS:

NON-AQUEOUS SAMPLE INFORMATION

1. NON-AQUEOUS MATRIX SAMPLED:

SOIL SEDIMENT SLUDGE CHEMICAL SOLIDS WASTE PILE

OTHER _____

2. TYPE OF SAMPLE: GRAB COMPOSITE IF COMPOSITE - SAMPLES/COMPOSITE _____

3. WAS THE VOA SAMPLE COLLECTED FIRST FROM A DISCRETE LOCATION PRIOR TO HOMOGENIZATION?

YES NO N/A

4. WAS THE SAMPLE HOMOGENIZED PRIOR TO ACQUISITION INTO THE SAMPLE CONTAINERS? YES/NO

5. TYPE OF SAMPLING EQUIPMENT:

	MATERIAL OF CONSTRUCTION			
	STAINLESS STEEL	TEFLON	GLASS	OTHER
SPOON/SPATULA	_____	_____	_____	_____
TROWEL/SCOOP	_____	_____	_____	_____
BUCKET AUGER	_____	_____	_____	_____
SPLIT SPOON	_____	_____	_____	_____
SHELBY TUBE	_____	_____	_____	_____
TRIER	_____	_____	_____	_____
PONAR DREDGE	_____	_____	_____	_____

6. WAS THE DRILL RIG, AUGER FLIGHTS, RODS, ETC. DECONTAMINATED ACCORDING TO STANDARD PROCEDURES BETWEEN EACH SAMPLE LOCATION? YES NO N/A

IF NO, METHOD OF DECONTAMINATION _____

7. IF MUD ROTARY DRILLING WAS UTILIZED WHAT WAS THE SOURCE OF THE WATER? _____

8. WAS THE SAMPLING EQUIPMENT DEDICATED? YES _____ NO _____

9. WAS THE SAMPLING EQUIPMENT: LAB DECONTAMINATED? FIELD DECONTAMINATED?

10. WAS THE SAMPLING EQUIPMENT DECONTAMINATED ACCORDING TO STANDARD PROCEDURES?

YES NO IF NO, METHOD OF DECONTAMINATION: _____

11. WAS THE DECONTAMINATION AREA LOCATED AWAY FROM THE SOURCE OF CONTAMINATION? YES NO N/A

12. ARE DISPOSABLE GLOVES WORN AND CHANGED BETWEEN EACH SAMPLE LOCATION? YES NO N/A

13. AUDITOR'S COMMENTS

QA/QC INFORMATION

1. LABORATORY:

NAME _____ PHONE _____

CONTACT PERSON _____

CLP CLP CAPABLE CERTIFIED OTHER _____

3. SAMPLE INFORMATION:

MATRIX	PARAMETER	PRESERVATIVE	CONTAINER DESCRIPTION
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

3. WHAT ORDER BY ANALYTICAL PARAMETER ARE SAMPLES COLLECTED: _____

4. FIELD BLANKS: YES NO N/A FREQUENCY _____

METHOD: _____

WAS IDENTICAL BOTTLE TO BOTTLE TRANSFER OF WATER UTILIZED? YES NO

5. TRIP BLANKS: YES NO N/A FREQUENCY _____

6. WHAT WAS THE SOURCE OF THE BLANK WATER? LABORATORY DEMONSTRATED ANALYTE-FREE
OTHER _____

7. SAMPLE PACKAGING AND HANDLING:

SAMPLE CONTAINERS LABELED	YES	NO	N/A
COC FORMS COMPLETED	YES	NO	N/A
CUSTODY SEALS	YES	NO	N/A
SAMPLES PRESERVED TO 4 ^B C:	YES	NO	N/A

8. AUDITOR'S COMMENTS

Attachment 9

SOP 4 - Procedure to Locate Sample Points Using a Global Positioning System (GPS)

Title: Procedure to Locate Sample Points Using a Global Positioning System (GPS)

I. Purpose

The purpose of this procedure is to provide reference information for the documentation of sample locations using a GPS at the Lower Passaic River Restoration Project Superfund Site.

II. Definitions

1. GPS - The GPS is a satellite-based positioning system, operated and controlled by the U.S. Department of Defense. The GPS includes 24 satellites, and can be used by anyone who has a GPS receiver. The GPS receiver is used for position determination, navigation, and survey tasks on land, sea, and in the air. The method of utilizing GPS varies with each application and the type of GPS equipment used. Operating methods range from low precision, code phase systems to highly accurate, carrier phase systems that facilitate on-the-fly measurements, also known as real-time kinematic surveying (RTK). The Lower Passaic River Restoration Project Superfund Site will use a hand held GPS receiver with sub meter horizontal accuracy to capture the coordinates of sample locations.

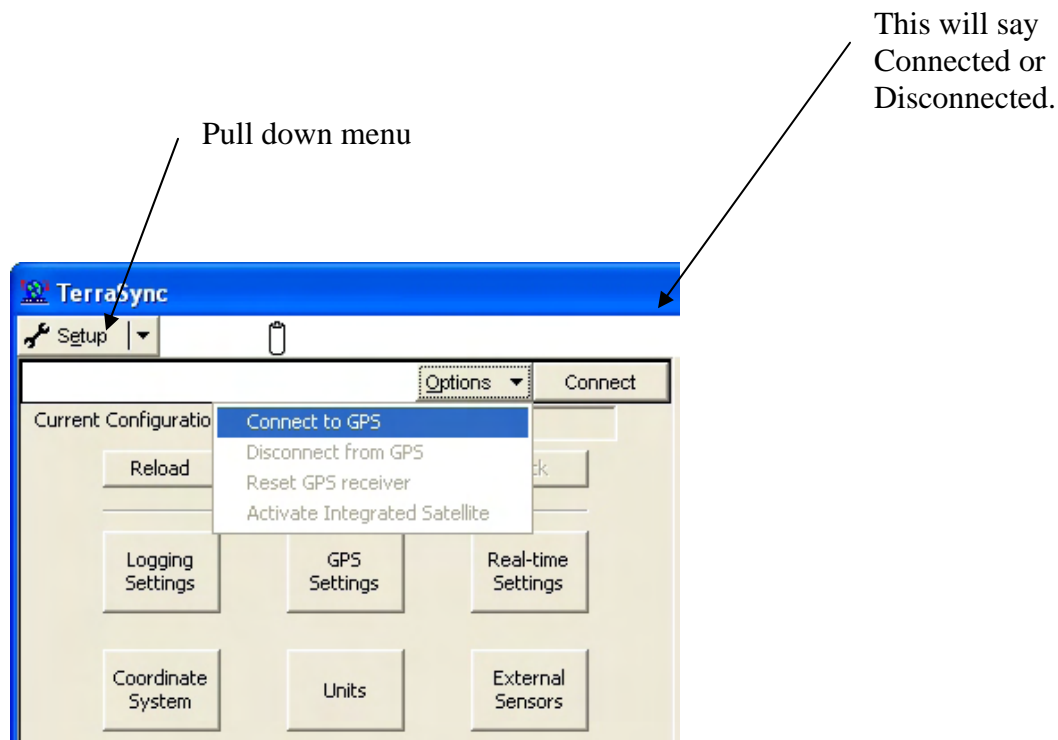
III. Equipment and Materials

1. Trimble Geo XT with related cable and power supply.

IV. Field Procedure

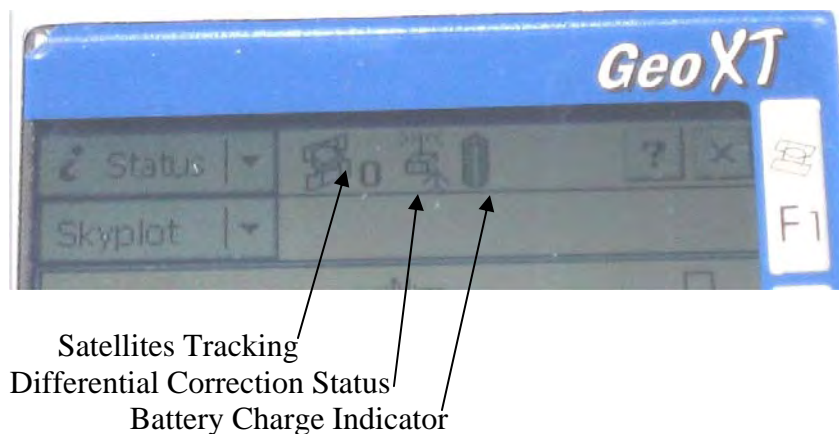
1. Getting Started

- A. Power up the unit by pressing the large gray button below the screen area and start the TerraSync application by selecting F1 or the Terra Sync icon. Wait about 5 minutes for the GPS unit to receive a new almanac and satellite information.
- B. Verify that the GPS unit is connected to the satellite network. After starting TerraSync, the status screen will appear, and will indicate if the GPS is connected or disconnected to the satellite network. If it is disconnected, use the stylus to click on the pull down menu in the upper left corner of the screen (see graphic below) and go to the Setup screen. Underneath the Setup pull down menu, select Options and select Connect to GPS.



2. Confirm Status of GPS

- A. The GeoXT will be collecting a new almanac and satellite readings. In the top tool bar you will see the number of satellites tracking, differential correction signal status, and the battery charge information. You must have 4 satellites available and the differential status must be on (i.e. the differential icon should not be blinking) to collect coordinate locations.



3. Confirm the Coordinate System

- A. In the Setup menu choose Coordinate System
B. On this screen you should see the following, or update entries to match:
System = US State Plane 1983
Zone = New Jersey 2900
Altitude = Mean Sea Level (MSL)
Altitude Units = Feet
Geoid = DMA 10x10 (Global)
Coordinate Units = Meters
Display USNG = Off

4. Create a File

- A. From the pull down menu in the upper left corner choose Data
- B. Select the Dictionary Named Passaic and name the file using the input panel (if the input panel is not automatically present click on the icon in the lower right corner that looks like a key board)
- C. Click Create

5. Collecting Point Data

- A. Using the pull down menu choose Map (you can also collect data from the Data menu but you will not see where you are on the map).
- B. Click on the blue circle in the upper right corner of the screen enter the name of the sample you are taking as well as the matrix (sediment or water).
- C. You can insure you are collecting satellite data by seeing a pen and wavy line icon to the right of the main pull down menu. You will also see the number of data sets you have gathered, the number of satellites that you are collecting information from and the status of the differential correction.
- D. When you have collected more than 3 sets of data (indicated by the number next to the pen and wavy line icon) select OK.
- E. You should now see your collected data as a square with an X in it on the map.
- F. Move to you new location and repeat step 5 until you are finished.

6. Closing the data and shutting down

- A. When you are finished using the GPS unit shut the application down by clicking the X in the upper right corner of the screen.
- B. You will be asked if you are sure you want to do this. Click yes.
- C. Press the gray button at the bottom of the GeoXT and bring it back to the office for processing.

V. Quality Control

The GPS has quality control features that are built into the system. The system will not allow measurements to be taken if there are not enough satellites available to provide accurate readings, if the satellite geometry is not conducive to the survey, and for other reasons. The system maintains quality control records during a survey that contain information about the quality of the GPS position, including the number of available satellites, satellite geometry, and horizontal and vertical precision levels. These records can be accessed when the data is post processed in order to assure that the necessary quality standards are being achieved.

Malcolm Pirnie Inc
Lower Passaic River Restoration Project
Standard Operating Procedure
Procedure to Locate Sample Points Using a
Global Positioning System (GPS)
Page 5 of 5

Procedure No.: SOP-4
Date: August, 2005
Revision No. 1

Prepared by: Scott Lehman
Reviewed by: Amy Atamian

VI. Reference

TerraSync Operation Guide. Trimble Navigation Ltd., 2002.

Attachment 10

SOP 7 - Decontamination of Water Sampling Equipment

Title: Decontamination of Water Sampling Equipment

I. Introduction

This procedure describes the methods used to decontaminate water sampling equipment and sample processing tools for the Lower Passaic River Restoration Project. The procedures specifically address equipment used to collect sediment samples.

II. Definitions

PPE - Personal Protective Equipment

III. Equipment and Supplies

The following equipment will be used to decontaminate equipment and tools used to collect water samples:

1. Tap water for initial cleaning and rinsing of equipment.
2. De-ionized water for final rinsing of equipment after tap water or solvent rinse.
3. Non-phosphate detergent (*e.g.*, Alconox™) for cleaning equipment.
4. Dishwashing detergent (*e.g.*, Joy™ which provides suds in seawater) to remove oily or organic residue.
5. Nitric acid as a 1% solution for removing metal contaminants from equipment
6. Isopropyl alcohol
7. Organic solvent for final cleaning of equipment (*e.g.*, hexane or equivalent)
8. Personnel protective equipment (PPE) - including disposable gloves (Nitrile preferred), disposable wipes, eye wash system, first aid kit, and waterproof outerwear (if necessary).
9. Re-sealable buckets approved for waste collection and transportation.
10. Squirt bottles for water, alcohol, and solvents.
11. Brushes for cleaning equipment.
12. Field notebooks, pens, pencils, and digital camera to document decontamination procedures.

IV. Guidelines

The following equipment will be used to collect water samples and require decontamination:

1. Infiltrax 300 Trace Organic Sampler: Pump, integral piping and other surfaces associated with the Infiltrax 300 Trace Organic Sampler's operation.
2. 5L Niskin bottles or equivalent.
3. Stainless Steel pressurized POP Canister
4. Vapor traps
5. Plastic tubing
6. Funnels
7. Graded cylinders
8. Graded tools used to measure river depth
9. Other equipment that comes into contact with the sample (*e.g.*, buckets, etc.).

Collection of water for laboratory analysis requires that the equipment be cleaned between sample locations to avoid sample contamination. Generally, the cleaning procedures to be followed between sample locations are as follows:

Decontamination: all sample collection tools that contact the sample as well as all bowls and mixing/distribution implements in accordance with the following procedures.

1. Disassemble item (except for Stainless Steel POP bottles and 5L Niskin or equivalent bottles at this stage).
2. Rinse each item with tap water.
3. For Stainless Steel POP Canister and 5L Niskin bottles (or equivalent): pour approximately 1 liter of non-phosphate detergent such as Alconox™ and lay on its side for at least 2 hours (roll the canister periodically to contact all interior surfaces).
4. Scrub the item with a brush and soapy water, using non-phosphate detergent such as Alconox™ for non-oily residue, or a detergent (*e.g.*, Joy™) for items with oily or other sticky organic residue. Prior to scrubbing, disassemble stainless steel containers, 5L Niskin bottles or equivalent, etc. Be sure to scrub the inside of canisters, bottles, etc. (inside and out), threads, cover bucket, etc. Soak stainless steel containers, 5L Niskin bottles or equivalent, etc. for 30 minutes to 1 hour; roll bottle frequently.
5. During the scrubbing process, be sure to bleed Alconox™ solution or equivalent through small passageways/nozzles/vents, etc.
6. Rinse the item with tap water to remove all residual soap. Be sure to bleed tap water through small passageways/nozzles/vents, etc.

7. Rinse the item with 10% nitric acid to remove residual metals. Be sure to bleed 10% nitric acid through small passageways/nozzles/vents, etc.
8. Rinse the item with de-ionized water. Be sure to bleed de-ionized water through small passageways/nozzles/vents, etc.
9. Rinse the item with isopropyl alcohol. Be sure to bleed isopropyl alcohol through small passageways/nozzles/vents, etc.
10. Rinse the item with de-ionized water. Be sure to bleed de-ionized water through small passageways/nozzles/vents, etc.
11. Rinse the item with organic solvent (*e.g.*, hexane or equivalent). Be sure to bleed organic solvent through small passageways/nozzles/vents, etc.
12. Rinse the item with de-ionized or analyte-free water and allow to air dry. Be sure to bleed de-ionized or analyte-free water through small passageways, nozzles, vents, etc.
13. Re-assemble item(s).
14. Wrap the item(s) in aluminum foil or plastic bag to protect it until it is used.

All solvents must be captured and disposed of in appropriate, labeled, aqueous waste containers. All instruments that come into contact with the sample water must be cleaned in the same manner as the sampling device. Liquids collected into the chemical waste container must be discarded in an appropriate waste stream. Staff performing decontamination procedures need to wear appropriate PPE, gloves (*e.g.*, Nitrile) and eye protection. Care must be taken in cleaning not to allow contact of cleaning solutions with clothing as much as possible. If circumstances dictate contact will occur (*e.g.*, splashing, high wind), waterproof outer clothing must be worn (*e.g.*, foul weather gear or rain gear).

Decontamination procedures may vary depending on specific Field Sampling Plan specifications, and unique contaminants of concern at specific locations. The project workplan may designate collection of equipment rinse samples to document effectiveness of cleaning.

This SOP does not address radioactive decontamination, PPE for radioactive waste, or disposal of radioactive contaminated waste material.

V. Reference

American Society for Testing and Materials (ASTM), 1994. Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites. Designation: D 5088 – 90.

Attachment 11

SOP 8 - Procedure for Sediment Probing

Title: Procedure for Sediment Probing

I. Introduction

This procedure describes the equipment and methods to be used to conduct sediment probing at the Lower Passaic River Restoration Site. This procedure specifically addresses probing the sediment at each core sampling location to determine the approximate sediment thickness and general sediment type.

II. Equipment and Supplies

The following equipment will be needed to conduct sediment probing:

1. Calibrated Steel Rod to investigate the sediment type, probe the thickness of unconsolidated sediments at each core sampling location, and to determine the length of core tubing to use.
2. Personnel protective equipment (PPE) - including hard hat, steel toe boots, and disposable gloves. (refer to HASP for full PPE requirements).
3. Log sheets to record all field collected data.

III. Guidelines

1. Using the on-board RTK DGPS system, maneuver the sampling vessel to within 10 ft (maximum distance) of the pre-programmed target coordinates for each core sample location, and stabilize the vessel as much as possible.

Confirm the location by examining the site map, bathymetric survey map, and landmarks.

2. Use a calibrated steel rod to probe the sediment. The probe should be sharpened at one end, and be calibrated at specific interval (*e.g.*, 6 inches).
3. Probing should be conducted 3 to 5 feet away from the sampling location to avoid disturbance of the sediment where the sample will be collected.
4. Push the sharpened end of the probe into the river bed, taking note of the depth of penetration and the type of resistance encountered. Use both hands and hold arms close to the chest to advance the probe vigorously when determining the depth extent of the unconsolidated layer.

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Reviewed by: John Logigian

5. When initial probe is complete, move the probe laterally and repeat the above probing step three or more times. Maintain the minimum three foot distance from the sampling location.
6. Record the average sediment thickness encountered (to the nearest 6 inches) and estimated sediment type (see guidance below) in the field log and the field application.
 - A. Bedrock refusal will have a distinctive “clink” and there will be no penetration.
 - B. Gravel or cobbles on top of the bedrock surface will produce multiple clinkings and the probe strikes the larger rock particles.
 - C. Sandy material will have a gritty or granular feel and will make a muted, raspy sound as the probe penetrates. There will generally be some resistance to probing, and that will increase with the depth of penetration.
 - D. Silty material will be smoother and will probably allow the greatest penetration. The probe will smoothly move through silts and will make little or no sound.
 - E. Clay will allow for a smooth penetration, but will be “stickier” than silt and will not allow as much penetration.
 - F. Sometimes finer materials will adhere to the probing rod and will allow for verification by pulling the rod out of the water.
7. If the probing results are inconsistent between the three locations, record the estimated sediment type as that which is the most representative of the three probes, and note the inconsistency in the field log and the field application.

IV. Reference

Memo: Sediment Probing Oversight Guidelines; Hudson River PCBs Superfund Site.
Dave Scheuing, TAMS. September 2004.

Attachment 12

SOP 20- Ultra-Clean Water Sampling Procedures for Mercury

Title: Ultra-Clean Water Sampling Procedures for Mercury

Adapted from information provided by Ultra-Clean Aqueous Sample Collection SOP by Frontier Geosciences

and

Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Criteria Levels, U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303), July 1996.

I. Introduction

This procedure describes the techniques used to obtain water samples for mercury analysis using Ultra-Clean Water Sampling Procedures. Mercury will be collected from up to two depth increments at up to five locations at pre-determined transects across the Passaic River. Samples will be collected to represent the cross section, managed as required, and shipped to the laboratory on the day of collection. These samples should be collected simultaneously with respect to each other.

II. Equipment and Supplies

1. Laboratory-supplied sample containers large enough to obtain sufficient volumes of water for analysis at each sample site within the river transect. Sample containers must be of Fluoropolymer or borosilicate glass construction with fluoropolymer or fluoropolymer-lined caps, since mercury vapors can diffuse in or out of other materials, resulting in contamination or low-biased results. All materials that will directly or indirectly contact the sample must be cleaned at a laboratory or cleaning facility using detergent, mineral acids, and reagent water as described in EPA Method 1631 for Mercury. The laboratory or cleaning facility is responsible for generating an equipment blank indicating that the sample containers and sampling equipment are free of trace metals contamination before they are shipped to the field team. An acceptable blank for mercury is free from contamination below the minimum level (ML) of 0.0005 micrograms per liter ($\mu\text{g/L}$). After cleaning, all sample containers are filled with a weak acid solution, individually double bagged, and shipped to the sampling site. All sampling equipment is also bagged for storage and shipment.
2. Carboy or other clean sample container filled with reagent water. For use with the collection of equipment blanks. The reagent water is to be handled the same as the

sampling containers. At least one field blank should be processed per site, or one every 10 samples, whichever is more frequent.

3. Peristaltic pump (e.g., ISCO, Masterflex, or equivalent): Either has its own power supply (i.e. internal battery) or can be operated using an external battery (i.e. automobile battery or similar).
4. Silastic medical-grade peristaltic pump tubing (estimate up to 1 foot to be used with each peristaltic pump head). Small segments of this tubing can also be used to join Teflon or Teflon-lined tubing to flow-thru cells, in-line sample filters, etc.
5. Teflon or Teflon-lined tubing: used to draw river water for sampling.
6. Pole made of non-contaminating material: to be attached to the end of Teflon or Teflon-lined sample tubing for the collection of water samples when using a peristaltic pump. Add visible foot increments on pole.
7. Laboratory-supplied grab sampling device: To be used as an alternative for collecting shallow water samples.
8. Braided or monofilament nylon, line: to be used as lanyard to hold inlet of Teflon or Teflon-lined tubing in position while sampling water column.
9. Teflon weight for holding Teflon or Teflon-lined tubing in place. Do not use a lead or metallic weight if collecting metals samples. Prepared for "clean-hands."
10. Field-portable glove-bag: I2R, Model R37-37H (nontalc), or equivalent. Additionally, a portable glove-box may be constructed with a non-metallic (PVC or other suitable material) frame, and frame cover made of an inexpensive, disposable, non-metallic material (e.g., thin-walled polyethylene bag).
11. Storage bags: clean zip type, non-vented, polyethylene type (various sizes).
12. Plastic wrap: clean, colorless polyethylene.
13. Cooler: clean nonmetallic with white interior.
14. Ice or chemical refrigerant packs.
15. Wind suit: unlined, long-sleeved consisting of pants and jacket constructed of nylon or other synthetic fabric.

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Reviewed by: John Logigian

16. If boat is used, it is recommended to be of non-metallic construction.
17. Buoys: needed to locate water sample locations.
18. Boat/Waders: needed to get to water sample location.
19. Personnel protective equipment (PPE): Shoulder-length gloves constructed from non-contaminating material (*i.e.* polyethylene). Also, PFDs on boats, waders, and HASP PPE such as protective gloves.
20. Miscellaneous Supplies – Garbage bags, decontamination supplies (Brushes, Alconox, water) tape measure, field book, digital camera, field application equipment, rubber mallet, deployment buoy and pulley system, 100' tape measure, ice, and GPS.
21. Hardcopy of EPA Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Levels, U.S. Environmental Protection Agency, Office of water Engineering and Analysis Division (4303), July 1996.

III. Guidelines

Prior to performing sampling methods:

1. Acquire appropriate preserved sample containers from the appropriate laboratory. Verify that the sample containers are of the proper construction and volume for the associated analytical procedure.
2. Inspect all sample containers for defects or contamination. Discard if defects are present or containers do not appear clean.
3. Prior to sampling, verify sampling locations using GPS and record location. Assess the need to set buoy in place prior to the day of sampling, if possible. This will permit rapid access to the proposed whole water sample location and minimize the amount of equipment carried the day of deployment.

Sampling Methodology: Become familiar with the following procedures and prepare for the sequence that follows.

1. Using a boat, travel to the pre-determined water sample buoy location, anchor the boat at a downstream location and **turn off the engine**. If possible, engine should be shut off at a distance far enough from the sampling point not likely to introduce contamination, and the boat should be manually moved to the sampling point (*i.e.*, wooden oars).
2. Make sure that the bow of the boat is adjacent to the proposed water sample location and that the boat engine is at the farthest possible location relative to the pre-determined water sample location, preferably downwind. Check the GPS location and verify that the location has not moved. Different tidal cycles, or wind events, will create an artificial shift in the GPS location due to the position of the buoy. If in doubt, tug on the line to verify that the weight is securely in place. Adjust as necessary. (Shallow locations, especially in tributaries, will be waded to.)
3. After arriving at the pre-determined water sample location and shutting-off the boat engine, make sure to shut-off generator or any other vapor emitting device. No fuel leaks or rags may be aboard the boat.
4. When wading, position yourself to collect samples upstream from the body. Avoid disturbing sediments in immediate area of sample collection.
5. Upon arriving at the sample site, one person from the two-person sampling team is designated as “dirty hands” and the second is designated “clean hands.” All operations involving contact with the sample bottle and transfer of the sample from sample collection device to the sample bottle are handled by the individual designated as “clean hands.” “Dirty hands” is responsible for the preparation of the sampler (except the sample container itself), operation of any machinery, and for all other activities that do not involve direct contact with the sample.

The following two methods may be used for the collection of the water sample for mercury:

Collecting water sample via grab sampling device:

1. The sampling team puts on gloves and wind suits. Ideally, a sample bottle will have been pre-attached to the sampling device in a Class 100 clean room at the

laboratory. If it is necessary to attach a bottle to the device in the field, “clean hands” performs this operation inside the field-portable glove bag.

2. “Dirty hands” removes the sampling device from its storage container and opens the outer polyethylene bag.
3. “Clean hands” opens the inside polyethylene bag and removes the sampling device.
4. “Clean hands” changes gloves.
5. “Dirty hands” submerges the sampling device to the desired depth and pulls the fluoropolymer cord to bring the seal plate into the middle position so that water can enter the bottle.
6. When bottle is full, (*i.e.*, when no more air bubbles appear), “dirty hands” pulls the bottle out of the collar, unscrews the bottle from the sealing device, and caps the bottle. “Clean hands” and “dirty hands” then return the bottle to its double-bagged storage by having “dirty hands” re-open the outer bag and “clean hands” opens the inside bag, places the bottle inside it, and zips the inner bag. “Dirty hands” then zips the outer bag.
7. Closing mechanism- “Clean hands removes the closing mechanism from the body of the grab sampler, rinses the device with reagent water, places it inside a new clean plastic bag, zips the bag, and places the bag inside an outer bag by “dirty hands.” “Dirty hands” zips the outer bag and places the double-bagged closing mechanism into the equipment storage box.
8. Sampling device- “Clean hands” seals the large inside bag containing the collar, pole, and cord and places the bag into a large outer bag held by “dirty hands.” “Dirty hands” seals the outside bag and places the double-bagged sampling device into the equipment storage box.
9. After each sample is collected, the sample number is documented in the sampling log, and any unusual observations concerning the sample and the sampling are documented.
10. Immediately place samples on ice and submit to laboratory.

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Collecting water sample via peristaltic pump:

1. Before putting on wind suits or gloves, the field team removes bags containing the pump, tubing, battery(ies), wind suits, and plastic wrap.
2. "Clean hands" and "dirty hands" put on the wind suits and protective gloves.
3. "Dirty hands" removes the pump from its storage bag, and opens the bag containing the Teflon or Teflon-lined tubing.
4. "Clean hands" installs the tubing while "dirty hands" holds the pump.
5. "Clean hands" installs the pump to a clean pole (pre-cleaned as prescribed in EPA Method 1631 for Mercury).
6. "Dirty hands" submerges the pole and end of the Teflon or Teflon-lined sampling tubing to the desired depth
7. Both "clean hands" and "dirty hands" change gloves. "Clean hands" also puts on shoulder lengthy polyethylene gloves.
8. "Dirty hands" turns the pump on and allows the pump to run for 5-10 minutes or longer to purge the pump and tubing.
9. "Dirty hands" must open the cooler or storage container, removed the double-bagged sample bottle from storage, and unzip the outer bag.
10. Next, "clean hands" opens the inside bag containing the sample bottle, removes the bottle, and reseals the inside bag. "Dirty hands" then reseals the outside bag.
11. "Clean hands" unscrews the cap, and while holding the cap upside-down, discards the dilute acid solution from the bottle into a carboy for wastes.
12. If the sample bottle has no preservative from the laboratory, the sample is collected by rinsing the sample bottle and bottle cap three times and collecting the sample from the flowing stream. If the sample bottle has preservative from the laboratory, it is filled directly from the flowing stream and not rinsed. Because of the risk of contamination, it is recommended that samples of mercury be shipped **unfiltered** by overnight courier and filtered when received at the laboratory. If preservation is required, the sample is acidified with appropriate preservative at this point. Preservation must be performed in the glove bag or in a designated

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clean area, with gloved hands, as rapidly as possible to preclude particulates from contaminating the sample.

13. "Clean hands" then replaces the cap of the sample bottle.
14. Once the bottle lid has been replaced, "dirty hands" re-opens the outer bag and "clean hands" opens the inside bag, places the bottle inside it, and zips the inner bag.
15. "Dirty hands" zips the outer bag.
16. After each sample is collected, the sample number is documented in the sampling log, and any unusual observations concerning the sample and the sampling are documented.
17. Immediately place samples on ice and submit to laboratory.

IV. Water Sample Collection Locations

Water samples will be collected at the locations, and at the depths, identified in the FSP.

V. References

Ultra-Clean Aqueous Sample Collection FGS-008.3, Frontier Geosciences, Seattle, WA, November 15, 2001.

Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Criteria Levels, U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303), July 1996.

Method 1631 Revision E: Mercury in Water by Oxidation, Purge Trap, and Cold Vapor Atomic Fluorescence Spectrometry, US Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303), August 2002.

Attachment 13

SOP 21 - Procedure for use of Horiba for measuring Water Parameters

Title: Procedure for use of Horiba for Measuring Water Parameters

Adapted from Horiba Ltd U-10 Water Quality Checker Instruction Manual.

I. Introduction

This procedure describes the equipment and methods to be used collect and process water quality data using a Horiba U-10 Water Quality Checker. The Horiba U-10 Water quality checker can be used to collect conductivity, turbidity, salinity, temperature, dissolved oxygen, and pH in water.

II. Equipment and Supplies

The following equipment is required to collect and store water quality data:

1. Horiba U-10 Main Unit which contains:
 - A. Cover for printer port.
 - B. Printer Post.
 - C. LCD Readout.
 - D. Keypad.
 - E. Cable Connector.
2. Horiba U-10 Cable
3. Horiba U-10 Probe which contains:
 - A. Dissolved Oxygen (DO) Sensor.
 - B. Conductivity Sensor.
 - C. Reference Sensor.
 - D. Temperature Sensor.
 - E. pH Sensor.
 - F. Turbidity Sensor.
 - G. Probe Guard.
4. Horiba U-10 Sample/Calibration Beaker.

5. Laptop computer with instrument interface software, field sampling data collection application.
6. 9-Volt battery for the instrument.
7. Vessel with DGPS navigation system.
8. Personal safety gear: including personal flotation devices (PFDs), waterproof outer wear, steel toed boots (waterproof if rough seas or weather), and mobile phone.
9. Calibration materials/solutions
10. Station logs, indelible markers/pens (*e.g.*, Sharpies™).
11. Horiba U-10 Instruction Manual.

III. Guidelines

1. Be sure to read and become familiar with the Horiba U-10 Instruction Manual.
2. Prior to field use, inspect probes on the bottom of the Horiba U-10 to verify that no cracks, discolorations, etc, exist on or around the probes.
3. Calibrate the Horiba U-10 per the manufacture's specifications (see Section 3, Horiba U-10 Instruction Manual). Keep in mind that pH and DO values change with temperature. Note pre calibration values, and instrument voltage settings post-calibration values in field application or instrument logbook. Calibrate Horiba U-10 as frequently as recommended by the manufacturer.
4. Clean the Horiba U-10 sample/calibration beaker and probes as specified in SOP-7: Decontamination of Water Sampling Equipment. Be sure to rinse the probes thoroughly with water. This should be performed prior to arriving at each sample location.
5. Turn the power for the Horiba U-10 to "On." The Horiba U-10 will be in the measure "MEAS" mode. After approximately 2 seconds, the Horiba U-10 readout will change to show that a new measurement is being made. Use the "SELECT" key to toggle the upper cursor to the parameter needed.
6. Prior to collecting water samples for laboratory analysis, place river water from the pump or other collection device/method directly into the Horiba U-10 sample/calibration beaker. Fill beaker to level specified by the manufacturer.

7. Place the Horiba U-10 probes directly into the Horiba U-10 sample/calibration beaker. All six parameters (DO, conductivity, temperature, pH, turbidity, and salinity) are measured instantly. Use the "SELECT" key to toggle the upper cursor to the parameter needed. These parameters may be stored in memory, printed-out, or viewed one-by-one on the readout. Note: never drop or throw the Horiba U-10 probe into the water; it can be damaged beyond repair by unnecessary rough handling.
8. After either collecting parameter measurements, discard the water in the Horiba U-10 sample/calibration container back into the river. Immediately clean the Horiba U-10 sample/calibration container per SOP-7: Decontamination of Water Sampling Equipment. Be sure to rinse the probes thoroughly with water.
9. Fill the Horiba U-10 sample/calibration beaker with deionized or equivalent water and fit the probe over it.
10. All data collected from the Horiba U-10 are recorded in the field computer. The data is stored in the instrument, and transferred periodically during the survey. Upon completion of sampling at one location, all ancillary data (*e.g.* date, time, position, etc.) is entered into the field application. The field application prompts the user for the required information and also automatically uploads daily weather and tidal conditions from the NOAA website. Blank field log sheets to record information manually will be provided in case difficulties with data entry into the field computer are encountered.
11. Water quality data should be reviewed as often as is practical to assure results are within expected ranges and the instrument is operating properly. Graphical plots or spreadsheet average/minimum/maximum review are suitable methods. If data is suspect, the discrepancy is noted in the field application, and the meter should be re-calibrated as soon as practicable.
12. After a successful profile, enter prompted information into the field application:
 - Date
 - Time of water column profile
 - Actual coordinates of the sample location
 - Water depth (ft)
 - Instrument Serial Number
 - Sensor data collected
 - Observations

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Reviewed by: John Logigian

13. At the end of each day, an electronic copy (disk) of the field application that includes the information recorded for each profile collected that day will be created as a back up of that day's project information. A copy of the signed field log form will be maintained by the field team leader.

IV. Reference

Horiba U-10 Water Quality Checker Instruction Manual, Horiba Ltd., November 1991.

Attachment 14

SOP 22 - Management and Disposal of Investigation Derived Waste

Title: Management and Disposal of Investigation Derived Waste

I. Introduction

This procedure describes the methods used to manage, store, and dispose of investigation derived waste (IDW) produced during environmental sampling for the Lower Passaic River Restoration Project. The procedures specifically address sediments, soils, water, solvents, and Personal Protective Equipment (PPE) waste generated from collection of sediment, soil and water samples and equipment decontamination.

This SOP does not address radioactive decontamination, PPE for radioactive waste, or disposal of radioactive contaminated waste material.

II. Definitions

PSO: Project Safety Officer
IDW: Investigation Derived Waste
PPE: Personal Protective Equipment

III. Equipment and Supplies

The purchase, maintenance, and use of the supplies and equipment listed below are the responsibility of the Project Safety Officer (PSO) and Processing Facility Manager.

The following equipment and supplies will be used to collect and dispose of investigation derived waste:

1. Waste Storage and Disposal Containers

- A. 30- or 55-gallon drums for solid and liquid wastes, including 30 gallon plastic drums for solids, and sealed top drums with screw-plug openings for liquids. As for liquid storage, steel (6D) drums will be used in the storage of solvent waste. For aqueous organic and acid waste, polylined (17E) drums will be used for storage.

2. Transferring Equipment

- A. Plastic safety funnels with brass or plastic screens and vents.
- B. Hand pump/siphon with Teflon or tygon tubing.
- C. Tools: screwdriver, drum plug wrench, and brass pliers.
- D. Drum dolly.

3. PPE

- A. Disposable Tyvex coveralls and/or lab coats.
- B. Disposable plastic gloves (nitrile, butyl rubber, or Viton).
- C. Respirator and cartridges (consult PSO to determine PPE requirements).
- D. Shoe covers (rubber or Tyvek).

4. Spill Cleanup Equipment and Supplies

- A. Spill absorbent (Vermiculite or Speedidry™).
- B. Broom, foxtail and dustpan.
- C. Shovel.
- D. Paper towels.
- E. 85-gallon overpack drum.
- F. Manual drum pump (same as pump in 'Item 2. Transferring Equipment').

5. Labels and Logs: A supply of labels and log sheets that are referred to in this SOP are to be kept on site in an easily accessible location, described in the Work Plan. Additional logs will be obtained from the Processing Facility Manager.

6. Digital camera to document IDW management.

IV. Guidelines

The following procedures will be used to store, manage, and transport IDW:

1. Waste Disposal: IDW is held in the appropriate designated storage area until approval for disposal is granted. After the PSO and Processing Facility Manager receive documentation on the level of contamination in the waste, they will assist the Project Manager in deciding whether the waste is suitable for disposal in a landfill, or must be discarded in a hazardous waste stream.

2. Solid Waste

- A. Solid waste is to be transferred into an air-tight, 30 gallon open top drum.
- B. The lid is to be removed from the collection container and the contents placed into the storage drum.
- C. Once the transfer has been completed, the lid and sealing ring are to be replaced on the storage drum.
- D. The transfer will be recorded on the waste transfer log, and this log will be placed in a location described in the Work Plan for reference.

Biological solid waste (e.g., fish, crab, tissue, net/trap residue) shall be sealed in double plastic bags, placed in open top drums (e.g., five gallon plastic pails with sealable lids, 30 gallon air-tight open top drum), and segregated for disposal. Containers for these materials shall be appropriately labeled.

3. Liquid Waste

- A. All solvents used for decontamination must be captured and disposed of in appropriate, labeled, aqueous waste containers. Liquids collected into the chemical waste container must be discarded in an appropriate waste stream. Care must be taken not to mix substances that will react with each other. If there is any question concerning compatibility, the PSO or Project Manager should be contacted prior to taking action. A record of the type, relative amount, and hazard associated with each substance added must be kept on the hazardous waste log. This log must be attached to the satellite container. Waste may be temporarily stored, if properly labeled, prior to satellite container introduction. The waste contents in these temporary storage containers must be introduced into an approved satellite container by the end of every working day.

B. Staff performing decontamination procedures need to wear appropriate PPE, gloves (*e.g.*, nitrile) and eye protection. Care must be taken in cleaning not to allow contact of cleaning solutions with clothing as much as possible. If circumstances dictate contact will occur (*e.g.*, high pressure washing, splashing, high wind), waterproof outer clothing must be worn (*e.g.*, foul weather gear or rain gear).

C. Liquid waste is to be transferred into an air-tight, 55-gallon, screw-cap drum. When a new drum is started, the larger cap is unscrewed with the drum plug wrench. The safety vent is screwed in and the cap tightened by hand.

4. PPE

A. PPE are to be transferred into air-tight, 30 gallon open top drums.

B. The lid is to be removed from the collection container and the contents placed into the storage drum.

C. Once the transfer has been completed, the lid and sealing ring will be replaced on the storage drum.

5. Project Safety Officer: Along with the Processing Facility Manager, the PSO is responsible for overseeing IDW collection and management and arranging for IDW to be disposed of off site in accordance with local, state, and federal Regulations. The responsibilities of the PSO and Processing Facility Manager include:

A. Packaging and labeling of containers.

B. Arranging for waste removal.

C. Maintaining manifest records and tracking the manifest until its signed and returned.

D. Conducting weekly inspections of the waste area.

E. Ensuring that the proper waste-handling materials and personal protective equipment are available and adequate (*e.g.*, gloves, coveralls, goggles, respirators and cartridges, boots, funnels, pumps).

F. Maintaining emergency spill response equipment.

Attachment 15

SOP 24 - Collecting Surface Sediments Using an Ekman or Ponar Dredge

Title: Collecting Surface Sediments Using an Ekman or Ponar Dredge

I. Introduction

This procedure describes the equipment and methods to be used to conduct surface sediment collection at the Lower Passaic River Restoration Site. For the purpose of this method, surface sediment is considered to range from 0 to 6 inches in depth. Collection of surface sediment can be accomplished with a system consisting of a remotely activated device (dredge) and a deployment system. This technique consists of lowering a sampling device (dredge) to the surface of the sediment by use of a rope, cable, or extended handle. The mechanism is activated, and the device entraps sediment in spring-loaded or lever-operated jaws.

An Ekman dredge sampling device is a lightweight sediment sampling device with spring activated jaws. It is used to collect moderately consolidated, fine textured sediment. For this project, once the sample has been retrieved, the Ekman will be operated in the top sampling mode and will therefore function as a box corer. It will be used to collect undisturbed sediments, taking care to preserve the quiescent sediment surface/water interface.

A Ponar dredge is a heavyweight sediment sampling device with weighted jaws that are lever or spring activated. It is used to collect consolidated fine to coarse textured sediment. Such a device will not be utilized for the sediment sampling activities proposed as it may disturb the depositional setting of the material during its deployment.

II. Equipment and Supplies

The following equipment will be utilized to conduct sediment sampling:

1. Ekman dredge and materials are described in the individual sections below.
2. Personnel protective equipment (PPE) - including steel toe boots (if aboard a boat), waders (if in a stream), and disposable gloves. (refer to HASP requirements for full PPE requirements).
3. Log sheets to record all field collected data.

III. Guidelines

Using the on-board RTK DGPS system, maneuver the sampling vessel to within 10 ft (maximum distance) of the pre-programmed target coordinates for each core sample

location, and stabilize the vessel as much as possible. Similarly locate the sampling position at stream or tributary locations.

Confirm the location by examining the site map, bathymetric survey map, and landmarks. Collect sample using Ekman or Ponar dredge using the following guidelines:

Ekman Dredge Guidelines (6 inch model):

1. Install and secure the polycarbonate Ekman liner.
2. Attach a sturdy nylon rope or stainless steel cable through the hole on the top of the bracket, or secure the extension handle to the bracket with machine bolts.
3. Cock the Ekman: Attach springs to both sides of the jaws. Fix the jaws so that they are in open position by placing trip cables over the release studs. Ensure that the hinged doors on the dredge top are free to open.
4. Lower the sampler to a point 4 to 6 inches above the sediment surface.
5. If the sampler is on a rope or cable, drop the sampler to the sediment. If an extension handle is used the sampler will be pushed into the sediment approximately 4 inches to prevent overfilling of the dredge.
6. Trigger the jaw release mechanism by lowering a messenger down the line, or by depressing the button on the upper end of the extension handle.
7. Raise the sampler evenly as jerking motions or excessive speed may disturb the sample. Slowly decant any free liquid through the top of the sampler. Care should be taken to retain the fine sediment fraction during this procedure.
8. Open the sampler jaws and transfer the sample into a stainless steel, plastic or other container by re-cocking the Ekman while it is resting on the container. Care should be taken to retain the fine sediment appropriate composition (e.g., Teflon) container. The liner, if used, will retain the shape of the sample inside of the Ekman and facilitate removal of sample in the field when it is positioned on a holder designed to accept the sample and liner. For Be-7 sample collection (usually the top 2 to 2.5 centimeters [1 inch]), for example, is collected from the top of the sediment surface. This portion of the sample should be removed from the Ekman through the top of the sampler, or while still in the liner after removed from the Ekman as discussed above. The liner may be marked on the outside to easily identify the amount of material to remove using decontaminated SS spoons or a SS flat blade (putty knife) bent to retrieve the sample efficiently. Ensure that non-dedicated containers have been adequately decontaminated. If necessary, continue to collect additional sediment grabs until sufficient material has been secured to fulfill analytical requirements. Thoroughly homogenize and then transfer sediment to sample containers appropriate for the analyses requested. Samples for volatile organic analysis must be collected directly from the bucket before homogenization to minimize volatilization of contaminants.

Ponar Dredge Guidelines (Guidelines are provided below. However, the Ponar shall not be used for this aspect of the project):

1. Attach a sturdy nylon rope or steel cable to the ring provided on top of the dredge.
2. Arrange the Ponar dredge with the jaws in the open position, set the trip bar so the sampler remains open when lifted from the top. If the dredge is so equipped, place the spring loaded pin into the aligned holes in the trip bar.
3. Slowly lower the sampler to a point approximately two inches above the sediment.
4. Drop the sampler to the sediment. Slack on the line will release the trip bar or spring loaded pin; pull up sharply on the line to close the dredge.
5. Raise the dredge to the surface and slowly decant any free liquid through the screens on top of the dredge. Care should be taken to retain the fine sediment fraction during this operation.
6. Open the dredge and transfer the sediment to a stainless steel, plastic or other appropriate composition (e.g., Teflon) container. Ensure that non-dedicated containers have been adequately decontaminated. If necessary, continue to collect additional sediment until sufficient material has been secured to fulfill analytical requirements. Thoroughly homogenize the sediment and then transfer sediment to sample containers appropriate for the analyses requested. Samples for volatile organic analysis must be collected directly from the bucket before homogenization to minimize volatilization of contaminants.

IV. Sample Preservation, Containers, Handling and Storage

Chemical preservation of solids is generally not recommended. Cooling to 4°C on wet ice is usually the best approach, supplemented by the appropriate holding time for the analyses requested.

Wide mouth glass containers with Teflon lined caps are utilized for sediment samples. The necessary sample volume will be determined as a function of the analytical requirements and specified in the Work Plan.

If analysis of sediment from a discrete depth or location is desired, sediment may be transferred directly from the sampling device to a labeled sample container(s) of appropriate size and construction for the analyses requested. Transfer is accomplished with a stainless steel or plastic lab spoon or equivalent.

If composite sampling techniques or multiple grabs are employed, equal portions of sediment from each location are deposited into a stainless steel, plastic, or other appropriate composition (e.g., Teflon) containers. The sediment is homogenized thoroughly to obtain a composite representative of the area sampled. The composite sediment sample is transferred to a labeled container(s) of appropriate size and construction for the analyses requested. Transfer of sediment is accomplished with a stainless steel or plastic lab spoon or equivalent. Samples for volatile organic analysis must be transferred directly from the sample collection device or pooled from

multiple areas in the homogenization container prior to mixing. This is done to minimize loss of contaminant due to volatilization during homogenization.

All sampling devices should be decontaminated, and subsequently wrapped in aluminum foil. The sampling device should remain wrapped until it is needed. Disposable sampling devices for sediment are generally impractical due to cost and the large number of sediment samples which may be required. Sampling devices should be cleaned in the field using the decontamination procedure described below.

V. Decontamination

Because decontamination procedures are time consuming, having multiple sampling tools available is recommended. All sampling equipment must be decontaminated prior to reuse.

Equipment decontamination will consist of the following 5 steps:

- 1) Detergent Wash
- 2) Tap water rinse
- 3) Acetone rinse
- 4) Deionized water rinse
- 5) Air Dry

All marker flags (if reused) should be decontaminated by wiping off with towels and/or baby wipes before re-use.

VI. Site Clean-Up

Excess sediment not included in the sample should be washed into the stream, pond, lake, or surface impoundment at the sampling location from which it was collected, or if applicable specific guidance in the site QAPP must be followed. Disposable personal protective equipment and other non-hazardous waste generated during sampling and decontamination activities will be placed in a trash bag and taken to a waste receptacle at the field office to prevent disturbance by animals and dispersion by wind. All non-hazardous waste will be disposed of in municipal waste bins.

VII. Health And Safety

When sampling from water bodies, physical hazards must be identified, and adequate precautions must be taken to ensure the safety of the sampling team. The team member collecting the samples should stay away from the edge of the water body, where bank failure may cause loss of balance. When collecting samples near the edge of water bodies, personnel must wear a lifeline. All sampling personnel must wear personal flotation devices (life vests). If sampling from a boat, appropriate protective measures must be implemented.

VIII. Record Keeping And Quality Control

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general procedures apply:

- Data must be documented on field data sheets or within site logbooks.
- Instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment calibration activities must occur prior to sampling/operation and they must be documented.
- Descriptions of any deviations and the reason for deviations from the site QAPP or this SOP should be noted in the field notebook, as necessary. In addition, the logbook should track pertinent sample collection information such as: sample date/time, personnel, weather conditions, and sample identification information. Samples taken from areas with visible staining or other indications of non-homogeneous conditions should be noted.
- Field personnel will collect the proper type and quantity of quality control samples as prescribed in the QAPP.

IX. References

Adapted from: SOP#EH-02, East Helena Site, Montana. September 2003

Mason, B.J. 1983. Preparation of soil sampling protocol: techniques and strategies. EPA-600/4-83-020.

Barth, D.S., B.J. Mason. 1984. Soil sampling quality assurance user's guide. USEPA-600/4-84-043.

USEPA. 1984. Characterization of hazardous waste- a methods manual: Volume II: Available sampling methods, second edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Steohen, D.L. Storm. 1980. Samplers and sampling procedures for hazardous waste streams. EPA-600/2-80-018.

Attachment 16

SOP 50 - Hand Coring Devices

Malcolm Pirnie, Inc.
Lower Passaic River Superfund Project
Standard Operating Procedure
Sediment Collection Using Hand Coring Devices

Procedure #50
Date: November 2007
Revision No. 2
Prepared by: John Hardin, Battelle
Revised by: F. Chris Purkiss

Title: Sediment Collection Using Hand Coring Devices

I. Introduction

This procedure describes the equipment and methods to be used to collect sediment cores at the Lower Passaic River Superfund Site. This procedure specifically addresses collection of sediment cores via hand operated coring devices (e.g., push coring and piston coring). Other coring methods (collection of sediment cores via vibracoring or split spoon and rotary drilling rig) are addressed in earlier documents.

II. Definitions

III. Equipment and Supplies

The following equipment will be needed to collect sediment cores:

1. **Push core** and ancillary equipment required for use.
2. **Piston core** and ancillary equipment required for use.
3. **Polycarbonate (Lexan) or Cellulose Acetate Butyrate (CAB) Tube** of appropriate diameter and wall thickness for use as the core barrel or as a liner within the coring apparatus. For this aspect of the project only polycarbonate tubes will be used.
4. **Hand operated winch** (e.g. 'come-along') and tripod or tetra pod (e.g. folding ladder) or other lifting frame if needed.
5. **Davit** or similar device.
6. **Personnel protective equipment (PPE)** - including steel toes boots, safety glasses, and disposable gloves (nitrile preferred).
7. Measuring tapes, scales, field books, pens, pencils, and pavement markers, digital camera, field application equipment, and GPS.
8. **Tape** – electrical, duct, and clear packing tape.

IV. Guidelines

1. Data from sediment core collection will be recorded in the laptop-based field application. Upon completion of sampling at one location, data from the core collection will be entered into the field application. The field application will prompt the user for the required information and also automatically upload daily weather and tidal conditions

from the NOAA website. Blank field log sheets to record information manually will be provided in case difficulties with data entry into the field computer are encountered. Manually recorded data will be transcribed into the field application at the end of each day.

2. Hand or piston cores are used when the water level is too shallow for the sampling vessel to navigate (*i.e.*, less than approximately 2 ft. of water), or a land site location is not accessible by large equipment (*e.g.*, truck or tractor rig). In shallow water, cores will be collected by wading into the water using chest waders. If on land (*e.g.*, intertidal or other location inaccessible by heavy equipment) appropriate PPE will be used for the hand collected sample. A hand held GPS/antenna will be used to determine the coordinates of the actual sampling location.

3. Using the hand held GPS system, mark a location within 5 ft of the preprogrammed target coordinates for each sample location. Record in the field application the actual location from which the core was collected and the target location.

4. Use a calibrated steel rod to probe the sediment surface 3 to 5 ft away from the target location to determine the sediment thickness and type in accordance with the Sediment Probing SOP - 8.

- If the estimated sediment thickness at the probing area is greater than 6 inches, record probing information in the field application and attempt to collect a core using the hand core device (steps 5-9).
- If the estimated sediment thickness at the probing area is less than 6 inches, additional probing of the sediment surface will be conducted within 3 ft of the target location for deeper sediments. If thicker sediments are found, relocate to the new location and attempt to collect a core (steps 5-9).

If sediment depth appears to be systematically less than 6 inches, make one attempt at collection with the hand core device. If 80% recovery is not achieved after one attempt, collect a sample with an Ekman dredge.

5. Once the targeted area is deemed suitable for core collection, take a clean coring tube and position it over the sampling location. Depending on the water depth and length of the core tube, determine if affixing the removal strap to the core tube should be done prior to, or after, driving the core tube.

HAND CORING PROCEDURES ARE INDICATED BY THE A) PROCEDURES, AND PISTON CORING BY THE B) PROCEDURES, BELOW.

6. A) Prior to pushing in the core tube, mark the target penetration depth on the outside of the tube. Lower the coring tube vertically through the water column (cutting edge first) until the sediment water interface is reached. Continue to push or hammer by hand the hand or piston core device until the target depth is reached. For this project the limiting factor for core penetration will be at refusal or upon reaching the red-grey historical clays. This layer will be determined during the sediment probing phase, if possible.

B) If using a piston core, follow the hand coring procedure above, however: first install the piston (double stopper mechanism with hook-eye and cord) approximately 2 inches from the bottom of the core. Run the cord up the core tube, through the post driver and attach securely to a Davit positioned over the sampling location. Alternatively, assure that the piston is held in place at the sediment surface throughout the process of driving the core into the sediment layer.

7. Measure and record the depth of core tube penetration into the sediments in the field database.

8. A) Pull the apparatus upward out of the sediment/soils (using a hand operated winch from a tripod or other lifting frame as needed), and raise it just above the sediment water interface maintaining the core in a vertical position.

B) Untie the cord from the Davit or other securing device. Snug up the piston cord and position the cord down the outside of the core tube. Secure the cord to the tube with duct/electrical tape assuring that tension is still on the cord within the tube. Pull the core tube upward as described above.

9. As soon as possible (while the core is still under water if possible) place a cap over the bottom of the core to prevent the loss of material from the core tube. Secure the cap in place with electrical or duct tape when brought on board the vessel, or while standing in the stream. If in a stream a board will be required as a base to the Jack when lifting the core tube.

10. Record the penetration depth in the field application. (Remove the core liner from the outer tube, if used.) Place a second cap on the top of the core tube. Secure the cap in place with electrical or duct tape. Rinse the outside of the core tube with a small amount of river water. Measure the recovered length of the sediment core and record the data in the field application.

11. Compare the length of the recovered core with the core penetration depth.

- If the recovered length of the sediment core is more than 80% of the penetration depth, keep the core.
- If an insufficient amount of material is recovered, put the core tube aside while additional attempts are made to meet recovery goals (see below). If a compliant core is obtained, discard the non-compliant core into a re-sealable 5-gallon pail and store for subsequent IDW disposal.
 - An additional attempt will be made at a minimum distance of 1ft from previously attempted locations.
 - A maximum of three attempts to collect a core will be made for a given location ID.
 - Rinse the core tubes with river water, or tap water and deionized water if river water is not available, between consecutive attempts.

- If all three attempts to collect a core are unsuccessful based on recovery alone (i.e., less than 80% recovery), retain the final core for analysis and put flag in the field application that indicates that the targeted recovery was not achieved.
- If an acceptable core cannot be collected within 3 ft of the node location, collect an Ekman dredge sediment grab sample, using the box core techniques identified in the Ekman SOP-24, and note conditions preventing core collection in the field database.

12. After a successful core recovery enter prompted information into the field application, if possible:

- Date
- Time of recovery
- Actual coordinates of the sample location
- Water depth (ft)
- Core tube material e.g., Lexan®)
- Core penetration depth (in)
- Observations, including probing results

13. Draw an arrow on the core tube with permanent marker to mark the top of the core. Label the core with waterproof label or permanent marker indicating station ID, date, and time.

14. Store the core vertically in a core tube cooler on ice. Use a tarp to keep the cores in the dark until they are transported to the field processing facility.

15. At locations where core samples cannot be collected, grab samples will be collected by lowering an Ekman dredge until it comes in contact with the sediment and the release mechanism is tripped. Follow the procedures in SOP 24 Collecting Surface Sediments Using an Ekman or Ponar Dredge.

16. Decontaminate the equipment and sampling tools according to procedures described in Procedure for Decontaminating Field Sampling Equipment SOP No. 7.

17. At the end of each day, an electronic copy (disk) of the field application that includes the information recorded for each core sample collected that day will be created as a back up of that day's project information. This information will also be transmitted to the processing laboratory coordinator via duplicate copy or it will be uploaded to a website for download by the laboratory coordinator. Additionally, a hard copy of the field application will be printed out. The hard copy will serve as a back-up to the electronic copy, as well as the chain of custody form from the field to the processing laboratory. This form will be signed by sample collection personnel and core processing personnel at the time that the core processing personnel take custody of the cores. A copy of the signed field log form will be maintained in the processing laboratory.

18. Cores will be processed as specified in the SOP –XX Processing of Low Resolution Sediment Cores.

IV. References

American Society for Testing and Materials (ASTM), 2000. Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes. Designation: D 1587-00

Attachment 17

SOP 51 - Trace Organics Platform Sampler (TOPS)

Trace Organics Platform Sampler (TOPS)

(Adapted from Stevens Institute of Technology SIT SOP#3)

1.0 General. The operating and cleaning procedures that will be used in this study are outlined below and should be consulted for detailed information regarding the operation and maintenance of this equipment. This document will provide the general reference to setting up, calibrating, and cleaning the TOPS samplers.

The TOPS consist of a peristaltic pump, flow-metering pump, 2-XAD columns, a glass fiber filter, and a flat glass fiber filter which will be used to collect samples for low-level organic contaminants in dissolved and suspended sediment phases. If possible the TOPS sampler will be used to collect suspended solids samples through filters for trace metals analysis.

To utilize the sampling device a field electrical generator (with fuel) is necessary. Because of electronic components of the sampler are sensitive to water damage the sampler **MUST** be covered with an impermeable material (plastic or similar) for use in the rain.

The specifics of operation, such as utilizing the TOPS sampler for the collection of solids in water only, omitting the XAD columns for the collection of the dissolved fraction, will be identified in the QAPP/FSP that is being followed for this aspect of the project. Therefore, the XAD portion of this SOP shall be omitted and the necessary by-passes utilized for the proper TOPS operation intended.

2.0 Cleaning. Each TOPS used for collecting ambient water samples at fixed locations will be cleaned prior to use in the Center for Environmental Systems laboratory, or other suitable facility. The sampler will be removed along with its sampling inlet tube connections and returned to the laboratory. Empty, dedicated XAD columns, the glass-fiber filter (GFF) holder, the flat filter holder, the inlet sampling tube connectors, and the inlet/outlet bulkhead fitting caps will be washed in hot, soapy (liquid phosphate-free laboratory detergent) water, rinsed first in tap water, then rinsed with de-ionized water (DI) between use.

After reinstalling the dedicated cleaning-columns and GFF holder in the TOPS, 10L to 20L of soapy tap water will then be pumped through the TOPS sampler using a dedicated Teflon sampling line. This sampling line will be stored in a sealed plastic bag between uses. A new piece of Master-Flex tubing (Cole Palmer tubing IP 82 tubing, 18 inches long) will then be installed in the pump head following the manufacturer's instructions. Then two 20-L rinses of clean tap water will be pumped through the TOPS. The empty

Malcolm Pirnie, Inc.
Lower Passaic River Restoration Project
Standard Operating Procedure
Trace Organics Platform Sampler (TOPS)

SOP-51
Date: November 2007
Revision No. 0
Prepared by: Dr. Tsan-Liang Su
(Stevens Institute of Technology)
Modified by: F. Chris Purkiss

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XAD columns will then be removed and the interior connection tube reconnected using the dedicated Teflon fittings. Metal parts will be rinsed in methanol and 5-10 L of de-ionized water will be pumped through the TOPS and held inline. Mechanical tube fittings will then be checked for tightness, and the sample inlet and outlet ports will be tightly capped using the dedicated stainless steel caps. The TOPS case door will be closed and locked for transport.

If a TOPS sampler has been used to collect sewer effluent or other oily, greasy, or extremely dirty samples, the sampling procedure outlined will be augmented by first disassembling internal tubing and fittings, washing them in hot soapy water and using a small brush to ensure their cleanliness, and then soaking the parts overnight in soapy tap water. The tubing and parts will be rinsed in tap water and in laboratory grade methanol, and then will be reassembled and then the previously outlined cleaning procedure followed.

The time, date, and initials of the TOPS cleaning will be recorded in the field notebook.

4.0 Handling filters-

Glass-Fiber Cartridge Filter (GFF) Installation-

GFF filters for the collection of suspended sediment will be cleaned by the manufacturer and then by the contract laboratory following laboratory procedures. Filters will be washed in clean methanol or hexane and baked at 400°C overnight. The GFF filters will be wrapped in methanol or hexane washed aluminum foil and double-bagged in reusable plastic bags for shipping. During installation of the GFF filters, the handler will wear a new pair of disposable vinyl laboratory gloves. The GFF filter holder will be removed from the TOPS sampler using a dedicated open-end or socket wrench and any remaining rinse water discarded. The filter will then be removed from its aluminum foil or other shipping container using clean, methanol rinsed stainless steel forceps and placed in the holder. The filter will be checked to ensure a portion of the filter is above the edge of the holder, which ensures a proper fit. The filter and holder will be immediately attached to the TOPS unit.

Changing GFFs and Removing-

After sufficient sample has passed through the XAD columns, or in the event that the GFF becomes plugged with sediment, the GFF will be removed and stored for transport. The field person will don a new pair of clean, disposable laboratory gloves. The GFF filter holder will be unscrewed from the TOPS sampler, and then the filter will be removed using methanol rinsed, stainless steel forceps and wrapped in a new, clean 24-inch square sheet of aluminum foil. The foil-wrapped filter is then placed in a new, re-sealable plastic bag, sealed, and the outside of the bag labeled with the sample identification, date, time, and location. The filter bag is then bagged again. The combined filters will be stored on ice until frozen in the laboratory.

If filter has become clogged, installation of a new GFF filter is necessary using the above procedure. If sampling has ended sediment in the "dead-space" water of the canister filter holder (approximately 450ml of fluid) will then be collected in the field by pouring the fluid into a wide-mouthed 500 ml bottle (manufactured by Nalge Nunc International, I-Chem 300 series). The can will then be rinsed with de-ionized water. (This sample will also be sent to the contracted lab for analysis.) In the lab, the canister water will be filtered by pouring the water into the filter assembly that contains a pre-cleaned and baked GFF flat filter (nominal pore size of 0.7 micron) and diameter of 90 mm. The bottle will be rinsed with de-ionized water and the water will then be filtered under pressure of laboratory grade nitrogen gas. The filtered water will be discarded. Once the water has been filtered, the filter paper will be removed and folded into quarters using stainless-steel forceps, wrapped in methanol-washed aluminum foil, and placed in the same reusable plastic bag package as its corresponding GFF sample and frozen.

In-line Flat filters

Filter pads in the inline filter holders (between the canister filter and the XAD columns or discharge) will be installed in the field before each event using methanol rinsed metal forceps. The filter holders will be wrapped in aluminum foil and bagged in a re-salable plastic bag for transport to the field. The filter holder will be installed in the TOPS using clean gloves. After sampling or if the filter becomes clogged, inline filters are changed. The used filter is removed from the holder using methanol-rinsed tweezers, folded in quarters and placed in aluminum foil, folded and bagged with other filters. Times and volumes passed through filters is recorded the field notebook. Inline filters will be sent in for analysis and become part of the filter pack that shares one Sample ID number. A new inline filter is replaced using methanol-rinsed tweezers if sampling is to continue.

5.0 Procedure for operating a TOPS sampler. The TOPS sampler will be used to collect samples of ambient water and suspended sediment. Initial steps for collecting a TOPS sample involve making the sampling line connections, installing the TOPS filters (canister and inline filters), and checking the tubing connections for necessary tightness.

To start the TOPS, connect the TOPS control box to the TOPS pump unit.
Connect TOPS inlet line to station inlet line – turn on booster pump if necessary
Connect TOPS outlet lines to station drain line, close clamps on sampling lines
Check that connections tightened
Check the large valve and waste valves are open

Turn main TOPS circuit breaker (CB) on
Turn TOPS initiate switch to INTERNAL
Turn meter switch on
Checked timer settings
Initiate Switch up
Record clock time in logbook

FMI Flow switch -
 CAL – calibration recorded?
 FLOW – RST and T/R
MF Waste Flow switch -
 CAL – calibration recorded?
 FLOW – RST and T/R

FMI Hour meter recorded?
TOPS cycle number recorded?

MF circuit breaker on – fill FMI lines

Stop MF

Put on XAD columns

Check that XAD columns labeled, spiked end of XAD column in upstream connection, and XAD fittings and caps are tight.

RST FMI flow meter

Start MF pump

Start FMI pump

Record TOPS data in logbook

Check GFF and fittings for leaks

Check that FMI hour meter is operating

Turn MF and FMI circuit breakers off

Turn TOPS initiate switch to external

Push SPA1156 reset switch

Check SPA1156 “latch” switch if appropriate

6.0 Accuracy of flow totalizer- The accuracy of the flow totalizer from the waste line (exiting the cartridge filter canister) in each TOPS sampler will be checked before and during each survey by collecting the water against time. For the pre-survey check, a GFF filter will be placed in the unit. These accuracy checks can be performed during the instrument cleaning procedures (described earlier) and the results recorded in the station. The pre-survey check will be performed at least three times, and averaged. If the average reading for the flow totalizer is less than 95% of the actual volume pumped, or if the rate differs by more than $\pm 5\%$ then the calibration of the meter will be changed using the procedure listed below. After changing, the accuracy of the flow meter will be rechecked and adjusted if necessary until the proper calibration is reached. During sampling the sampler will check the accuracy of the flow totalizer by collecting and timing a known volume of waste water from each of the TOPS waste lines, and comparing it to the totalizer amount and rate. If the TOPS totalizer differs by more than 5% from the collected amount or rate, then the test will be repeated at least two more times. If the average rate or amount differs by more than 5%, then the flow totalizer will be adjusted. Tests and adjustments will be recorded in the station logbook.

In addition, due to the previously observed inaccuracy of the FMI flow meter and flow totalizer, water passed discharged from the TOPS sampler will be collected in graduated 20L carboys, measured, and recorded on the appropriate TOPS form in the field notebook.

7.0 Additional TOPS Operational Information

This additional information regarding the operation, schematic of typical TOPS operation, and other operating parameters are provided below. Training of field personnel will be provided by Stevens trained personnel prior to the collection of samples on this project. This additional information includes parts of the TOPS which may or may not be utilized. Final operation will be based on the requirements stipulated in the QAPP/FSP. Training will include the setup of the TOPS to operate as a particulate filter and not to collect dissolved fraction. Instructions will be provided for the proper operation to collect the maximum amount of particles on the cartridge as is practical in the field. Pumping until just prior to clogging will be the goal, if achievable.

The procedures/methodology provided below are general guidelines which will be adjusted to satisfy the requirements of the QAPP/FSP and the changing field conditions.

PROCEDURES / METHODOLOGY

7.1 Description of the TOPS Set-up

Water quality monitoring will be performed using Stevens Modified TOPS (SIT_TOPS) sampler units (see SIT-SOP 3). A schematic of the SIT_TOPS units is shown in Figure 1.

Each TOPS unit used for the water quality sampling is equipped with a plankton net, filters to remove sediments from the ambient water, and two XAD resin columns to retain trace organics (dioxins, PCBs and pesticides).

The plankton net is manufactured by Wildlife Supply Company, Bolt Cloth-Nitex, 100um and it is placed in a 2L teflon jar equipped with ½” male connectors.

Each TOPS unit is equipped with two types of filters and two resin columns in series:

- A baked 0.5 µm nominal size retention and 4” long Cartridge GFF filter (C-GFF) located in the discharge line of the peristaltic pump right after sampling port 1. The GFF filter is pre-cleaned by STL Inc.
- A 142 mm diameter in-line 0.7 µm GF/F Whatman glass microfiber filter (“In-line Flat filter”) pre-cleaned by STL Inc. located before the XAD columns.

Malcolm Pirnie, Inc.
Lower Passaic River Restoration Project
Standard Operating Procedure
Trace Organics Platform Sampler (TOPS)

SOP-51
Date: November 2007
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Prepared by: Dr. Tsan-Liang Su
(Stevens Institute of Technology)
Modified by: F. Chris Purkiss

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- Two XAD columns connected in series between the in-line flat filter and the FMI pump. The XAD columns are provided by STL Inc. The first XAD column is spiked by STL Inc. with PCBs and pesticides prior to its shipment to Stevens.

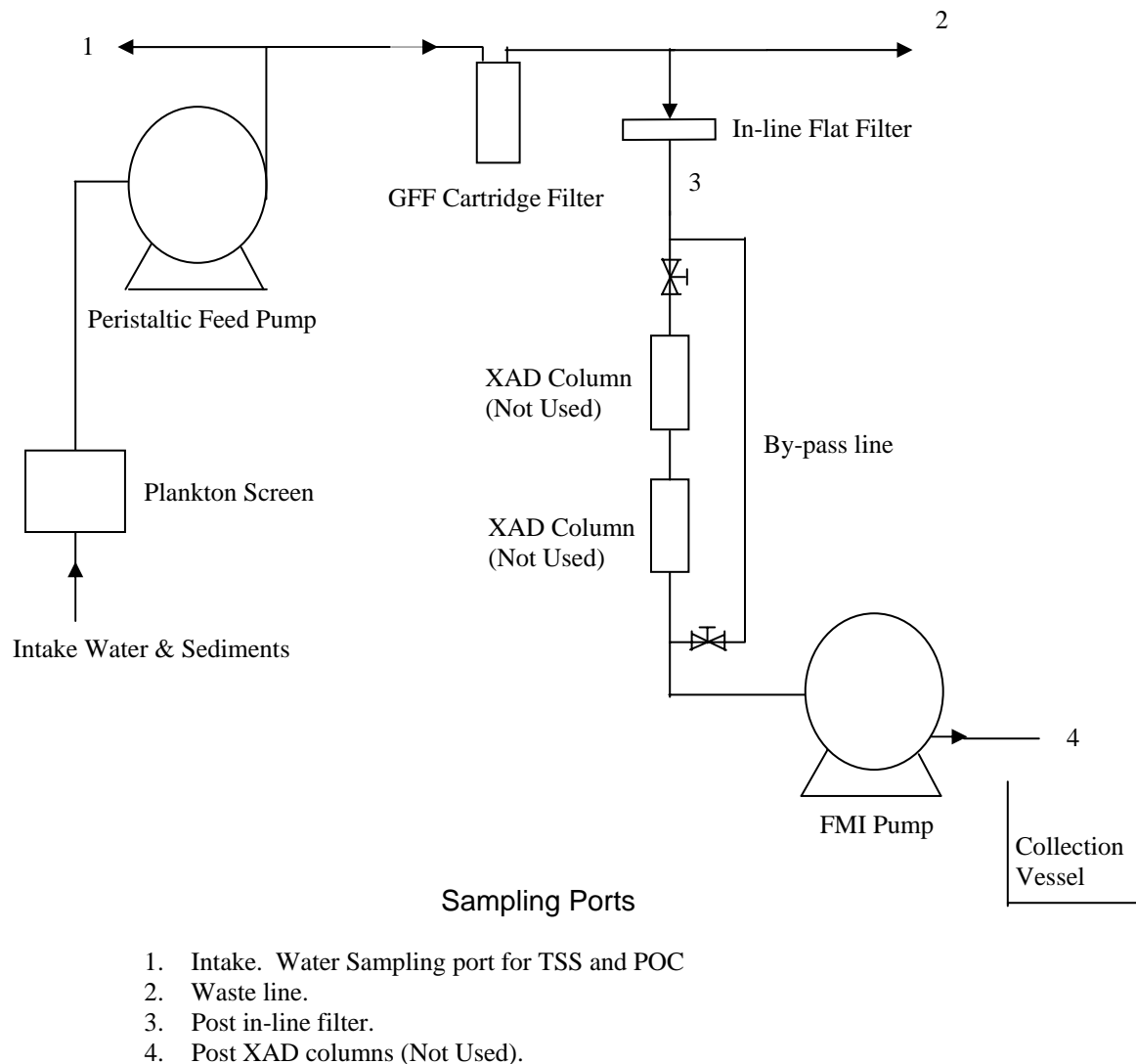


Figure 1: Schematic Diagram of the Stevens Modified TOPS Sampler (SIT_TOPS)

7.2 TOPS operating parameters

The peristaltic feed pump flow rate will be set at approximately 2000 ml/min. The flow rate of the FMI pump will be set at approximately 350 ml/min and will be monitored so that it will not go below 200 ml/min. The flow rates delivered by the peristaltic feed pump and the FMI pump will be monitored at 30 minutes intervals. The inline filters will

be replaced as needed in order to maintain the flow rate in the FMI line above the 200 ml/min threshold value. Based on the above considerations, the duration of the sampling event will be 4 hours to insure that a minimum of 50L of filtered ambient water flows through the device.

7.3 Sampling

For the water quality monitoring program, each SIT_TOPS unit will be in operation until the required amount of solids necessary for analytical procedures has accumulated in the cartridge. If an insufficient mass is collected after 6 hours of pumping the procedure will be stopped.

Flat filters (sediment fraction) will be replaced as needed, and will also be used to collect materials smaller than are collected by the cartridge filter.

In addition, a total of two one-liter samples per TOPS run will be taken for TSS and POC one at the start and one at the completion of sampling.

Attachment 18

SOP 52 - Filtration of Suspended Solids from Waters

Title: Filtration of Suspended Solids from Waters

I. Introduction

This procedure describes the equipment and methods to be used to field filter suspended solids from waters to be sent for offsite laboratory analysis for metals. Refer to the QAPP/FSP for this aspect of the project to determine if clean-hands techniques are required for the samples being collected. Alternately, the samples can be filtered by the laboratory.

II. Equipment and Supplies

The following equipment will be needed to conduct sediment probing:

1. **Peristaltic Pump** with Silastic pump-head tubing (such as C-flex tubing) used to obtain the water sample from a tributary of CSO-SSO source without contacting any internal pump mechanisms. The utility of the peristaltic pump is restricted to approximately 20 to 25 feet of lift. The pump may be battery operated with spare batteries for long duration sampling, if necessary, or as backup power, if a generator is in place the pump should be 110 Volts Alternating Current (AC).
2. **Laboratory Prepared In-Line Cartridge Flat-Filter and Sample Tubing.** Flat-filters and sample line tubing shall be prepared by the laboratory as stipulated in the QAPP/FSP. Clean-hands procedures may be necessary if specific mercury analysis is detailed in the QAPP.
3. **Discharge container.** A discharge container shall be used to collect the filtrate for totalizing the flow through the flat-filter. The discharge container may consist of a 1 liter plastic graduated cylinder. A larger container may be poured into the graduated cylinder to obtain a true measurement of the total flow through the filter. The container may also be used if larger volumes of filtrate are anticipated.
4. **Personnel protective equipment (PPE)** - including steel toe boots, and disposable gloves (refer to SSHP for full PPE requirements), as needed.
5. **Clean-Hand Gloves and Equipment.** If clean-hands protocols are being followed then sample tubing and filters need to be laboratory prepared, as well as long-sleeved clean-hands gloves.

III. Guidelines

1. A GPS system will be used to identify the sampling location, as necessary. Where overhead cover is restrictive, such as is the case along the tributaries, measurements shall be referenced to permanent features such as dams, gauges, or trees.
2. Using clean-hands protocols, if necessary, attach the peristaltic pump head Silastic tubing to the pump, attach the intake Teflon-lined tubing (lab clean-hands prepared) to the intake side of the flat-filter, attach the discharge side of the flat-filter to the intake side of the pump-head tubing, and place a discharge container under the discharge end of the pump-head tubing to obtain an accurate measurement of the filtered volume.
3. Insert the intake line into the water source (e.g., tributary, Upper Passaic, CSO/SSO, or Interceptor line).
4. Start the pump at a rate slow enough to assure that water is continually flowing through the filter. As the flow-rate drops (due to clogging) remove the intake tubing from the flat-filter and continue operating the pump until all the water has passed through the flat-filter. **IT IS CRITICAL THAT THE INTAKE LINE ON THE FLAT-FILTER REMAINS IN A VERTICAL ORIENTATION (THIS END UP). IF THIS IS NOT DONE THAN THE SOLIDS COLLECTED ON THE FLAT -FILTER COULD BE WASHED OFF WHEN THE TUBING IS REMOVED, INVALIDATING THE FILTERING CONDUCTED.** If the sample is dislodged from the filter a new sample collected on a new flat-filter must be collected.
5. Turn off the pump
6. Repackage the flat-filter as required by the clean-hand procedures, as necessary.
7. Drain all remaining water from the pump-head tubing into the discharge container.
8. Measure and record the total volume of water passing through the filter.
9. Parts of the sampling device will be dedicated for each sample collected. Therefore, new tubing and filters are required for each sample.

IV. Duplicate Samples

Duplicate samples, as needed, will be collected by running an additional pump, with identically specified tubing and filters. Flow rates will be approximated and intake lines will be held at the same water depth and the samples will be collected simultaneously.

Attachment 19

SOP 53 - Core Processing-Low Resolution Sediment Cores

Malcolm Pirnie, Inc.
Lower Passaic River Superfund Project
Standard Operating Procedure
Core Processing-Low Resolution Cores

Procedure #53
Date: November 2007
Revision No. 2
Prepared by: Jessica Fahey, Battelle
Revised by: F. Chris Purkiss

Title: Core Processing-Low Resolution Cores

I. Introduction

This standard operating procedure (SOP) describes the process for managing, segmenting, characterizing, and sampling associated with chemical and geotechnical analyses. Proper handling is critical for ensuring quality data on programs involving the collection and analysis of deep sediment. This processing procedure applies to sediment cores collected using a variety of samplers, including vibracore, hand or gravity cores,. Low resolution cores are those cores segmented into subsamples at 6-inch to 1-foot intervals to characterize the vertical extent of contamination and physical properties (the segmentation interval will be determined during the design of the Low Resolution Coring Program and subsequently documented in this SOP).

For sediment sampling during the November 2007 through January 2008 event the segments for the collected cores have been stipulated in the QAPP/FSP Addendum as 0"-6", and 6" to the bottom of the core or the red/brown clay material, whichever is first encountered.

II. Definitions

Definitions are referenced from the ASTM D2488-00: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Please refer to ASTM D2488-00 for more detailed definitions.

Clay: fine-grained soil with putty-like properties (plasticity) when containing water. If the soil is dry then it becomes hard, strong, and solid. Has a plasticity index equal to or greater than 4.

Gravel: particles of rock that are larger than 4.75mm yet smaller than 75 mm
Coarse: greater than 19mm smaller than 75mm
Fine: less than 19mm larger than 4.75 mm

Organic Clay: clay with organic content high enough to influence soil properties

Organic Silt: silt with organic content high enough to influence soil properties

Peat: dark brown to black decomposing vegetative matter with organic odor and spongy consistency

Sand: particles of rock between 75 μm -4.75mm
Coarse: 2 mm-4.75 mm
Medium: 425 μm -2 mm
Fine: 75 μm -425 μm

Silt: a fine-grained soil ($<75 \mu\text{m}$) with little or no plasticity. When soil is dry has little or no strength.

III. Equipment and Supplies

1. Geotechnical Gauge- typically contains size classification, with actual sand grains from coarse to silt, roundness chart, percent composition chart, unified soil classification system, common soil colors, soil and sand compacting classifications.
2. Environmental Sample Core Log: use to record core characterization (Attachment 1)
3. Key to Core Data Logs- guide to core descriptions and symbology (Attachment 2)
4. Solvents: typically Acetone and DCM to clean utensils
5. Decontaminated stainless steel bowls and scoops
7. Engineering Tape Measure
9. Cores
10. Disposable Gloves
11. Tyvek Suits
12. Utility Knife
13. Safety Glasses
14. Sample Jars
15. Reciprocating Saw and/or Aluminum Tubing Cutter
16. Scale
17. Extruding device

18. Drill

IV. Guidelines

1. **Core Storage:** Core storage is a vital part of the process. The cores must be kept at the appropriate temperature (generally 4°C) and in the appropriate orientation (vertical) until they are cut open and segmented for subsample analysis. It may be necessary to initially cut cores into two or more segments so that they will fit into a vehicle for transportation to the core processing facility. This can be accomplished using a reciprocating saw (Lexan cores) or tubing cutter (Aluminum cores) with a decontaminated blade. All exposed ends of the cores will be recapped following cutting, and the core segments will be labeled with the core designation, location, depth intervals, and an arrow to denote the proper orientation.
2. **Holding times** vary depending on the analysis of the samples. Below are standard times commonly used. Please refer to the SOP for “Sample Containers, Preservation, and Handling” for specific holding time and storage parameters and the latest QAPP/FSP Addendum.
 - Cores for chemical analysis have a probable holding time of 1-2 weeks, depending on the selected analytical parameters. These cores must be processed and submitted to the laboratory prior to holding time unless they are frozen.
 - Cores for physical parameters such as Grain Size and certain engineering parameters should not be frozen. They should remain at 4°C to prevent composition changes in the sediment.
3. **Setup:** Cores that must be processed vertically will be held in specially-constructed core processing stands. Personal protective equipment and air monitoring must be used as required by the Health and Safety Plan. Tools and mixing implements must be cleaned and decontaminated as described in the next section.
4. **Decontamination:** Decontaminate all tools, bowls, and mixing implements in accordance with the following procedures.
 - Rinse each item with tap water to remove mud or dirt.
 - Scrub the item with a brush and soapy (*i.e.*, alconox) water.
 - Rinse the item with tap water again to remove any residual soap.
 - Rinse the item with acetone.
 - Rinse the item with DCM.
 - Wrap the item in aluminum foil to protect it until it is to be used.

5. **Bulk Density:** Bulk density of each core will be determined by first determining the weight of an empty core tube and calculating the weight per foot of tube. The sediment length will be determined. Excess water will be drained from the core tube.

The core tube with the sediment will be weighed.

Bulk density calculation will be calculated based on the ID of the core tube and the data generated from above.

5. **Core Segmentation and Sampling:** After the weights and lengths are obtained for the bulk density calculation the cores will be segmented as follows:

Cores are to be processed vertically. Typically the core is segmented at predetermined intervals (generally 6 inch- or 1 foot-intervals). Segmentation and sampling go hand and hand with this process. Segmentation will be conducted using a tubing cutter for aluminum core tubes or a reciprocating saw for Lexan core tubes. As the top segment is cut from the top of the core tube, a large, decontaminated, flat-bladed knife or stainless steel plate will be inserted below the segment and used to lift the segment into a decontaminated stainless steel bowl for extrusion, classification, and sample processing. (A second option is to use an extrusion device to push the core out one end may also be utilized.)

For the second, (which is also the last segment) segment from 6" through the bottom of the core, or until the red/brown clay layer is reached the following procedure will be followed: As this desired core section emerges from the extruder, it is pushed off onto a flat clean surface. (During this process if the core is capable of remaining intact then this may be done while the core is held horizontally.) The outside "smear layer" is scraped off and an equally representative depth of material is removed from the top of this layer to the "end" of the core with a decontaminated SS spoon and placed in a decontaminated SS mixing bowl. Sufficient material will be removed to fill all the sample jars, and duplicates as needed. The remaining sample will be left for classification, as required. Reminder: Slicing away the outer edge of the core is important after extrusion to assure core streaking/smearing is not a factor contributing to cross-contamination of the sample.

6. **Sample Containers:** The SOP "Sample Containers, Preservation, and Handling" has more detailed information. Below are some standard requirements for sediments.
 - Samples to be analyzed for physical parameters such as grain size and TOC should be stored in pre-cleaned glass jars.
 - Samples to be analyzed for chemical parameters should be stored in pre-cleaned glass jars.

- Samples to be analyzed for metals parameters should be stored in precleaned, tared polystyrene containers or wide mouth, certified precleaned glass with Teflon lined lid.

7. **Core Logging:** To describe the sediment cores an Environmental Sample Core Log (Attachment 1), a Geotechnical Gauge, and the Key to Core Data Log (Attachment 2) are required. Sample classification requirements stipulated in the QAPP/FSP will be performed.

Measure the total length of the core and record it on the Environmental Sample Core Log. Describe the core(s) in the diagram provided on the Environmental Sample Core Log. For each horizon note the color, size (segment length), texture, lithology, and odor. Also note other distinguishing characteristics such as shell hash, detritus, or presence of an organic sheen. Use Attachment 2 as a reference for additional data collection requirements. Note not all categories apply to all samples. These are a guide to the information that can be provided by a core description. Specific descriptions of each category are listed further along in this document. If a photographic record is to be obtained, the core ID should be present in every frame as well as an RGB color indicator and a measuring tape for size reference.

3. **Group Symbols:** Soils can be identified by assigning a group symbol. Flow charts representing these group symbols can be seen in Attachment 4 (fine-grained soils) and Attachment 5 (coarse-grained soils).
4. **Lithology:** The description or physical characterization of the soil such as clay, silt, or sand.
5. **Dilatancy:** the structural change of the soil from stress and pressure over time. This can be tested by shaking and squeezing a small round ball of the sample. The ASTM criteria are listed below and details on how to test the sample are listed in the ASTM D2488 report.
 - None: No visible change in the specimen
 - Slow: Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
 - Rapid: Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.
6. **Type:** a more descriptive means of describing the soil characters such as soil size and composition.
7. **Color:** a very important aspect of the core description and soil identification. Any changes in color should be noted on the sample log along with the location of the color boundary. Use a Munsell Soil Color Chart (can be on Geotechnical Gauge) to acquire uniform descriptions.

8. **Consistency:** using the symbols on the Key describe the consistency as hard, firm, soft or very soft. Note this is not applicable to soils with large amounts of gravel. The ASTM criteria are as follows:
- Very soft: Thumb will penetrate soil more than 1 in
 - Soft: Thumb will penetrate soil about 1 in
 - Firm: Thumb will indent soil about ¼ in
 - Hard: Thumb will not indent soil but readily indented with thumbnail
 - Very Hard: Thumbnail will not indent soil
9. **Cementation:** used on intact coarse-grained soils. The three options are weak, moderate and strong. The ASTM criteria are as follows:
- Weak: crumbles or breaks with handling or little finger pressure
 - Moderate: Crumbles or breaks with considerable finger pressure
 - Strong: will not crumble or break with finger pressure
10. **Structure:** physical layout of the core. Below are descriptions of the ASTM criteria noted on the “Key to Core Data Logs” (Attachment 2).
- Homogeneous: Same color and appearance throughout
 - Stratified: Alternating layers of varying material or color with layers at least 6 mm thick; note thickness
 - Laminated: Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness
 - Mottled (Lensed): Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
11. **HCl Reaction:** drop small amounts of HCl on the soil to see the reaction. Use ASTM criteria of none, weak, or strong. (This will not be performed.)
- None: no visible reaction
 - Weak: some reaction, with bubbles forming slowly
 - Strong: Violent reaction, with bubbles forming immediately
12. **Maximum particle size:** note the largest particle size seen in the sample. The “Key to Core Data Logs” has the appropriate abbreviations and descriptions. More details can be found in the ASTM D 2488 paper.
13. **Odor:** Note any organic or non-organic odors that may be released when opening the core. Many soils have a strong, distinctive odor of decaying vegetation. It is important to also note any chemical or petroleum odors.
14. **Samples:** Used to identify sample ID. Also, this column can be used to denote where the core may have been split to acquire numerous samples.
15. **Toughness:** the amount of pressure need to roll a sample of the soil into a 1/8th inch diameter (plastic limit) thread and the strength of the thread. The ASTM criteria are listed below.

Low: Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.

Medium: Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.

High: Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

16. **Plasticity:** using the information gathered in the toughness test use the ASTM criteria to rate the plasticity of the sample.

Non-plastic: A 1/8 in. thread cannot be rolled at any water content.

Low: The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.

Medium: The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.

V. References

ASTM International Designation: D 2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Edition 2000

VI. Attachments








1. Blank Environmental Sample Core Log Form
2. Key to Core Data Logs
3. Example of completed Environmental Sample Core Log Form
4. Group Symbol Flow Chart for fine-grained soils
5. Group Symbol Flow Chart for course-grained soils

Reviewed by _____ Date _____

Attachment 2 Key to Core Data Logs

KEY TO CORE DATA LOGS

LITHOLOGY

	Clay
	Silt
	Sand
	Pebbles
	Shells
	Roots/organic matter
	Worms/worm tubes

TYPE

GW	Well-graded gravels, gravel-sand mixtures
GP	Poorly-graded gravels, gravel-sand mixtures
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands, gravelly sands
SP	Poorly graded sands, gravelly sands
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Silts and very fine sands, silty or clayey fine sands, or clayey silts, with slight plasticity
CL	Clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
MH	Silts or fine sandy silts with moderate plasticity
CH	Clays of high plasticity, fat clays

COLOR

Selected from Munsell Soil Color Chart

CLAY/SILT CHARACTERISTICS

DILATANCY

N = None
S = Slow
R = Rapid

TOUGHNESS

L = Low
M = Medium
H = High

CONSISTENCY

Penetration of thumb:
<0.25 cm = hard (H)
0.25 – 2.0 cm = firm (F)
2.0 – 4.0 cm = soft (S)
>4.0 cm = very soft (VS)

CEMENTATION

N = Not cemented
W = Weakly cemented
M = Moderately cemented
S = Strongly cemented

STRUCTURE

H = Homogeneous
S = Stratified
L = Laminated
M = Mottled

HCl REACTION

N = None
W = Weak
S = Strong

MAXIMUM PARTICLE SIZE

SC = Small Cobble
CP = Coarse Pebble
MP = Medium Pebble
SP = Small Pebble
CS = Coarse Sand
MS = Medium Sand
FS = Fine Sand
VFS = Very Fine Sand
Z = Silt

SA = Sub-angular
VA = Very angular

ODOR

N = None
S = Sulfide; HS = Hydrogen sulfide
P = Petroleum

PLASTICITY

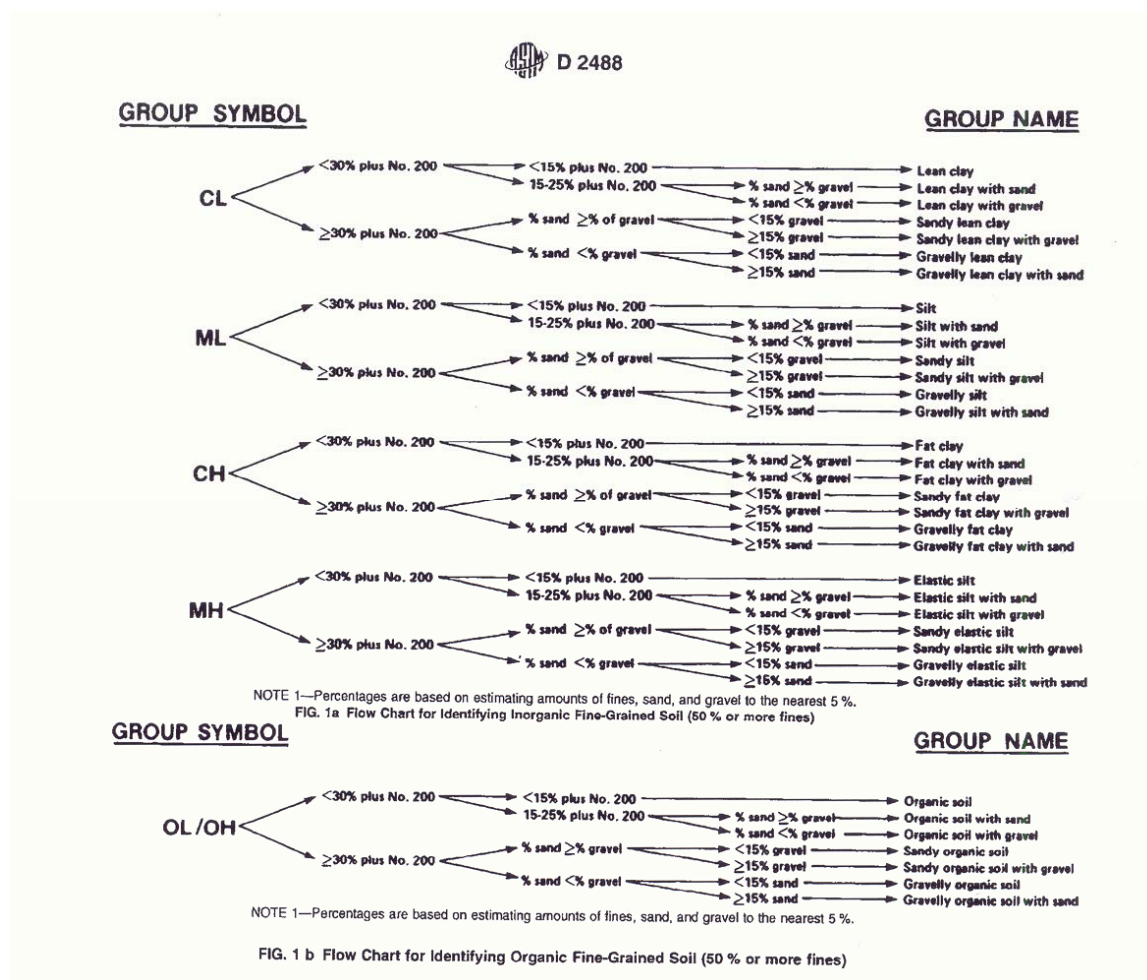
N = None
L = Low
M = Medium
H = High

Attachment 3 Completed Environmental Sample Core Log Form

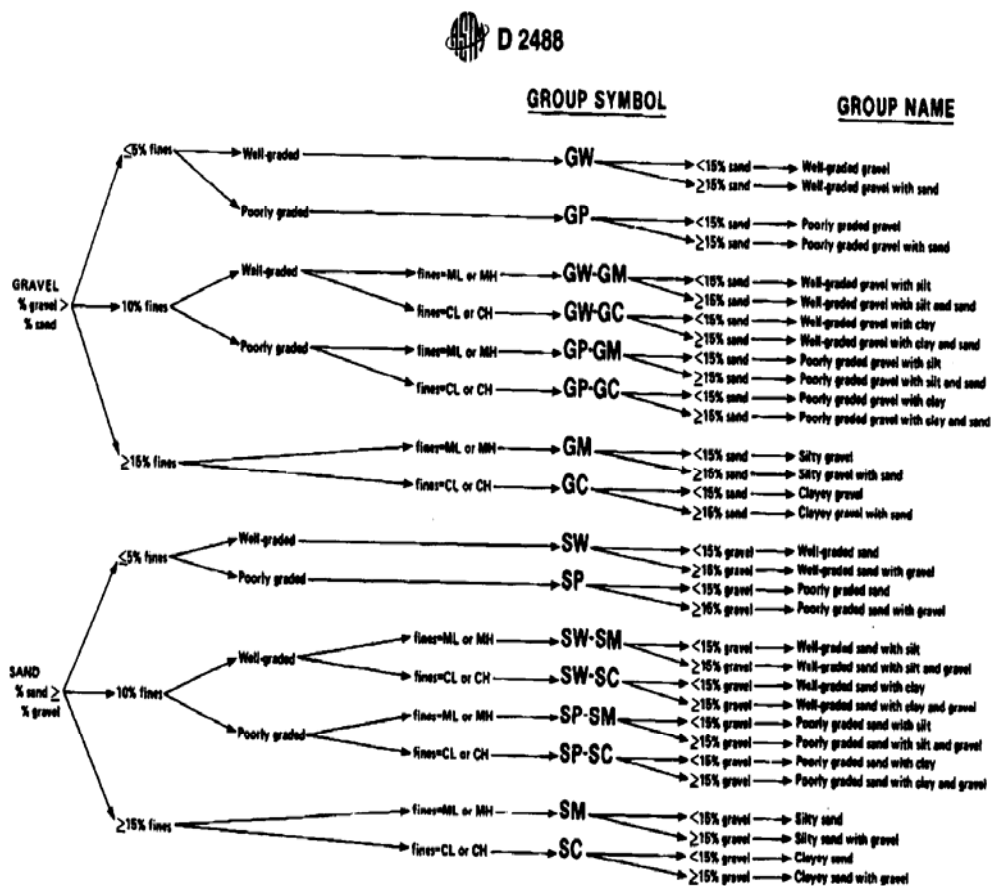
Project Title:

Core Descriptor (Station):		Core 1		Core Sample ID:		A11							
Logged by:		J. Smith		Date:		10/18/2007							
				Page		1 of 1							
Depth below mudline (ft)	Lithology	Dilatancy	Type	Color	Consistency	Cementation	Structure	HCl reaction	Maximum particle size	Odor	Samples	Comments	
1		N/A	ML	5Y2.5/1 black	VS	N	H	N/A	FS	S	A11 0-2'	v. soft black silt with some fine sand	
2											A11 2'-4'		
3													
4					S					H		A11 4'-5'	hydrocarbon smell between 4'-5'
5		SW	10YR6/1 grey	H					CS	N		X	transition to sand; contains black silt, sand, some pebbles
6			10YR5/1 grey-brown									A11 5'6"-7'3"	medium to coarse sand with small cobbles at base of core, v.hard, moderately sorted. At 5'-10" v. coarse, angular to subangular sand in 1" layer
7									SC				
7'3"												Core collected 10/14/2007 at 1134 by B. Smith.	
8													
9													

Attachment 4 **Group Symbols** **Flow Chart for Fine-grained Soils**



Attachment 5
Group Symbols
Flow Chart for Course-grained Soils



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)

Attachment 20

SOP 54- Collection of Water Outflow Samples

Title: Collection of Water Outflow Samples

I. Introduction

This procedure describes the methods for collecting whole water samples from combined sewer overflows (CSO) and storm water outfalls (SWO) using a peristaltic pump. The collected samples will then be submitted to the selected laboratory for the filtration of suspended solids with subsequent analysis of the solids. The analyses is specified in the QAPP/FSP including and the analyses of suspended solids filtered by the laboratory for metals and or organics on the suspended solids. Refer to the QAPP/FSP for this aspect of the project to determine if modified clean-hands techniques are required for the samples collected. Alternately, if conditions permit water samples can be collected by dipping pre-cleaned sample containers into the water outfall.

If dissolved phase samples are to also be collected the laboratory will produce the dissolved phase sample during the filtration of the suspended material, followed by XAD column extraction of the dissolved material.

II. Equipment and Supplies

The following equipment will be used to conduct CSO-SWO sampling:

1. **Peristaltic Pump** with Silastic pump-head tubing (such as C-flex tubing) connected to Teflon lined pre-cleaned sample tubing (see below) used to obtain the water sample from a CSO-SWO source without contacting any internal pump mechanisms. The utility of the peristaltic pump is restricted to approximately 20 to 26 feet of lift. The pump may be battery operated with spare batteries for long duration sampling, if necessary, it may also be equipped with alligator clip connections to provide power from a vehicle battery. In some instances a generator may be used to power a 110 Volts Alternating Current (AC) pump.
2. **Laboratory Prepared Sample Tubing.** Sample line tubing (Teflon lined) shall be prepared by the laboratory as stipulated in the QAPP/FSP. Weights shall also be attached by the laboratory. Modified clean-hands procedures for mercury sampling is detailed in the QAPP. Laboratory pre-cleaned tubing shall come connected to the peristaltic pump tubing directly from the laboratory. Tubing shall be clean-hands rinsed and bagged.
3. **Personnel protective equipment (PPE)** - including steel toe boots, and disposable gloves (refer to SSHP for full PPE requirements), as needed.

4. **Clean-Hand Gloves and Equipment.** If clean-hands protocols are being followed then sample tubing needs to be laboratory prepared. Since the media of concern ultimately is the solid phase nitrile gloves shall be worn during the sampling events.
5. **Pre-Cleaned Samples Containers.** Samples for metals analyses will be collected in pre-cleaned 4 L glass bottles. Samples for organics will be collected in decontaminated 20 L stainless steel containers or in multiple proofed 4 L glass bottles.

III. Guidelines

1. Prior to setting up the pumps the overflow or outfall the tide chart will be referenced to determine if the tide gate will be in the closed position. Sampling will only be conducted when there is flow over the regulator and through the tide gates.
2. Then the manhole will be opened and inspected for active flow. Using a pick-ax and pry bar carefully slide the manhole cover back.
3. The tide gate, at CSO locations, will be inspected to make sure that it is open and that there is flow.
4. A Horiba sonde will be used to determine if, at saline locations, the tidal water has been displaced from the sampling location. A GPS system will be used to identify the sampling location, as necessary. CSO-SWO sampling locations are from manholes therefore a GPS reading will be taken, when available.
5. Using clean-hands protocols, if necessary, attach the peristaltic pump head Silastic tubing to the pump and attach the intake Teflon-lined tubing (lab clean-hands prepared with weight attached) to the Silastic tubing. (This assembly is prepared and connected at the laboratory.)
6. Insert the weighted intake line into the water source (e.g., CSO/SWO). It is important the intake of the tubing be submerged just below the floating debris in the chamber yet above the sediment on the bottom, which has accumulated over time.
7. Start the pump at a slow rate and proceed to fill the sample containers. The sample containers for metals and mercury should be collected first using gloved hands following the modified clean-hands procedure, followed by the samples for organics (PCB congeners, Dioxins/Furans, Pesticides and PAHs) and the other analyses such as particulate organic carbon and total suspended solids required by the QAPP. At least one sample for total suspended solids must be collected during the sample event.
8. When the jars are full turn off the pump. Do not overfill the containers.
9. Pack the samples on ice as needed and ship samples to the laboratory.
10. Parts of the sampling device, specifically the tubing train, are dedicated and require replacement prior to sampling at each location and for each sampling event.

Malcolm Pirnie, Inc.
Lower Passaic River Restoration Project
Standard Operating Procedure for
Collection of Water Outfall Samples

Procedure No.: SOP-54
Date: December 2007
Revision No. 0

Page 3 of 3

Prepared by: James McCann
Reviewed by: F Chris Purkiss

IV. Duplicate Samples

Duplicate samples, as needed, will be collected by running an additional pump, with identically specified tubing and filters. Flow rates will be approximated and intake lines will be held at the same water depth and the samples will be collected simultaneously.

Attachment 21

SOP BRL-0107- Filtration for Collection of Particulate From Water Samples, Brooks
Rand Labs

COPY

BR-0107
Revision 001
Page 1 of 8

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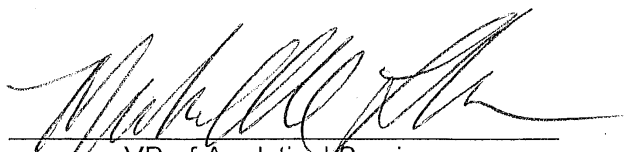
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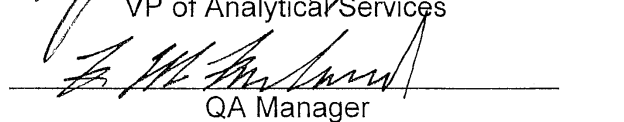
Filtration for Collection of Particulate from Water Samples

Brooks Rand Labs

Written 12/10/07
Revision 001

Reviewed _____



VP of Analytical Services


QA Manager

12/12/07

Date
12/12/07

Date

Filtration for Collection of Particulate from Water Samples

1. DESCRIPTION

- 1.1. Definition: The filtration of water samples (with little or no contribution of metals contamination due to the filtration) where the particulate matter from the samples is collected for analysis. This can be performed in the field or in the laboratory.
- 1.2. Scope: To remove solids at a predetermined size from water sample without contamination, thereby collecting the particulate for independent analysis.
- 1.3. Summary: Polycarbonate filters of a predetermined pore size (typically 0.45- μm) are placed in a precleaned Teflon[®] filter housing. Sample is pumped through the filter housing and particulate is collected on the filter. The filter is removed and is available for analysis of trace metals following other SOPs.
- 1.4. Holding Time: Ideally, samples should be filtered in the field with the Teflon[®] filter housings placed in-line. Alternatively, the filtration can take place in the lab, but this should happen as soon as possible following collection to minimize the impacts of pH and other compositional changes. Brooks Rand Labs has assigned a holding time of 2 days between sample collection and filtration. Samples filtered outside of this holding time are qualified "H" for improper sample handling.
- 1.5. Considerations: Filters are 0.4- μm pore size, not 0.45- μm . This should be cleared with the client. Also, you must be very careful in filter and filter housing handling, and the instructions below for post-filtration handling must be followed carefully.

2. EQUIPMENT

- 2.1. Pre-tested hydrochloric acid (HCl) and/or pre-tested nitric acid (HNO₃) – depending on the metals to be tested for.
 - 2.1.1. For THg only, only HCl is needed.
 - 2.1.2. For ICP-MS metals only, only HNO₃ is needed.
- 2.2. Ultra-pure reagent water from deionization/reverse osmosis system (DIW) for cleaning equipment and for preparation of the filtration blank.
- 2.3. Peristaltic pump and associated pump head tubing (precleaned). Ideally, the pump head tubing would also be pre-tested; however, since we are collecting the particulate from the sample, ultra-trace level cleanliness is not required.

2.4. Sample Tubing

2.4.1. For in-house filtration, use 1/4" i.d., 7/16" o.d. silicon tubing. Tubing must be pre-cleaned and should be pre-tested; however, since we are collecting the particulate from the sample, ultra-trace level cleanliness is not required.

2.4.2. For field-filtration, the recommended tubing is 3/16" i.d., 1/4" o.d. Teflon[®] tubing, and 1/4" i.d., 7/16" o.d. silicon tubing. However, 3/8" i.d., 5/8" o.d. silicon tubing may be used with 3/8" i.d., 1/2" o.d. Teflon[®] tubing if secured tightly with a zip-tie and carefully monitored for leakage. Tubing must be pre-cleaned and should be pre-tested; however, since we are collecting the particulate from the sample, ultra-trace level cleanliness is not required.

2.5. Whatman Nuclepore Track-Etch 47-mm polycarbonate membrane filters with 0.4- μ m pore size. Testing results have shown that these are clean enough for use directly from the packaging; no pre-cleaning is necessary to achieve standard MDLs for particulate on filters.

2.5.1. Although 0.45- μ m filters would be preferable, polycarbonate filters have not been sourced in that pore size. Teflon[®] filters in the 0.45- μ m pore size are available from Savillex (part #1121).

2.5.2. The client must be made aware that the particulate that is being collected is $\geq 0.4 \mu\text{m}$, instead of the standard definition of $\geq 0.45 \mu\text{m}$.

2.6. Savillex Teflon[®] Series-47 Filter Holders (part #6T-47-6T). If filter holder wrenches are available, these could be useful in tightening the clamp nut on the filter holder. Teflon[®] filter housing units will be pre-assembled in the laboratory. Parts include (in order of flow):

2.6.1. Threaded Teflon[®] inlet piece with 3/8" o.d. male inlet tubing attachment (inlet plug also must fit on this end)

2.6.2. Teflon[®] threaded collar (aka clamp nut)

2.6.3. Teflon[®] filter holder mesh base, which fits into 2.6.4

2.6.4. Teflon[®] filter base support with 3/8" o.d. male outlet tubing attachment (outlet plug must also fit on this end)

2.6.5. All filter holder pieces should be pre-cleaned. Ideally, these would also be pre-tested; however, since we are collecting the particulate from the sample, ultra-trace level cleanliness is not required.

- 2.6.6. Some Teflon® filter housing units may have different attachment options on one or both end, such as ferrule nuts for tubing.
- 2.7. End plugs for filter holders (2 each).
- 2.8. Plastic tweezers (pre-cleaned).
- 2.9. Teflon® bombs (1 per sample and 1 per filtration blank), cleaned according to BRL SOP.
- 2.10. Pre-tested FLPE and pre-cleaned HDPE bottles for collection of filtrate, if required.
- 2.11. Static master
- 2.12. Graduated cylinder, 1-L size
- 2.13. Batch filtration log sheet (Exhibit A).

3. PROCEDURE

- 3.1. Filtration should, ideally, take place in the field. Upon request, an unpreserved sample (or a portion of an unpreserved sample) can be filtered in the lab to remove and collect any particulate matter found in that sample. That particulate can then be analyzed for trace metals, including mercury.
- 3.2. Acceptance of Samples for Filtration in the Laboratory:
 - 3.2.1. Ideally, a minimum of 4-L of sample (in one container) is submitted for lab filtration. If samples have high levels of TSS, then less volume may be required.
 - 3.2.2. The client must be notified if any of their samples requiring filtration do not meet the following criteria. At a minimum, any results for collected particulate samples that do not meet the criteria must be qualified "H" as estimates.
 - 3.2.3. All samples for filtration must be received and maintained unfrozen at $0-4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ until filtration in order to minimize compositional changes due to microbiological activity.
 - 3.2.4. Generally, samples should be filtered as soon as possible after collection. All filtration must take place within 48 hours or 2 days of collection. BRL policy is to qualify the particulate metal result for any sample filtered after 48 hours or 2 days.

3.3. Sample Filtration in the Laboratory:

3.3.1. Assemble filter units one at a time as follows:

3.3.1.1. Working in a clean hood and wearing clean-room gloves, remove a Teflon[®] filter housing units from the Ziploc bag.

3.3.1.2. Set the filter housing unit on a clean benchliner ensuring the parts of the housing that will touch the filter are facing up.

3.3.1.3. Using pre-cleaned plastic tweezers, remove a polycarbonate filter from the box and carefully place in on the filter holder mesh base. [Make sure you don't include the paper filter divider.] Use the static master to reduce the static charge – wave the filter in front of the source prior to placing on the filter holder base. Do not wet the filter, as this could cause it to tear.

3.3.1.4. Place the inlet part of the hold over the filter, and, holding firmly, screw on the clamp nut. If needed, use wrenches to tighten the clamp nut down firmly.

3.3.1.5. Place end plugs on both end of the filter, closing off the inlet and outlet ports.

3.3.2. Set up peristaltic pump and attach the silicon pump head tubing. Tubing should go from the sample bottle, through the pump head, and to the filter unit.

3.3.3. Filter samples – Sample filtration should be performed with two people (called Tech 1 and Tech 2 below). Both techs must wear clean-room gloves, which should be changed between samples. Filtration should take place in a clean hood.

3.3.3.1. Collect samples to be filtered, filtrate collection bottles, DIW for filtration blank, and prepared filter units.

3.3.3.2. Tech 1 should hold the outlet tubing so that it will drain into a filtration collection bottle.

3.3.3.3. Tech 2 should shake the sample bottle so that it is continually be well mixed and hold the inlet tubing in the sample.

3.3.3.4. Turn the pump on and pump as much water sample through the filter as will reasonable be filtered, collecting the filtrate in the graduated cylinder.

3.3.3.5. Record the volume of filtrate on the log sheet

3.3.4. Ensuring all particulate is on filter

3.3.4.1. Remove filter and run DIW through to rinse all particulate down onto the filter.

3.3.4.2. Purge the filter with inert gas (nitrogen or argon) to purge remaining DIW out of filter.

3.3.5. Transfer filter to Teflon[®] bomb

3.3.5.1. Carefully open filter holder

3.3.5.2. Remove filter with tweezers and place in bomb

3.4. Sample Filtration in the Field

3.4.1. Gather supplies

3.4.2. Filter samples

3.4.3. Ensuring all particulate in on filter

3.4.4. Shipping filter unit to lab

3.5. Analysis and Reporting

3.5.1. Digest filters as prescribed in the appropriate SOP.

4. QUALITY ASSURANCE

4.1. Filtration Blanks

4.1.1. For each set of samples to be filtered, blanks should be filtered and analyzed at a minimum frequency of one per sample collection day (for field filtration), or one per sample tracking/work order number in the filtration batch for lab filtration, or one per filter lot used, whichever is greater.

4.1.2. Each filtration blank must be logged in with the samples on the chain-of-custody (COC) form (for field filtration) or on the sample receiving log for lab filtration. Filtration blanks must be batched out with their associated samples.

4.1.3. For filtration blanks, the same process is used as for samples except that DIW is used. The exact same process must be followed.

4.1.4. After filtration, the filter is transferred into a clean Teflon[®] bomb stored in the same manner as the filters for the client samples. Do not reuse the Teflon[®] filter housing unit for the next sample, as the filter may tear when placed into wet filter unit.

4.1.5. If the results from the filtration blank are significant relative to the results obtained from the actual particulate samples, the particulate sample results should be qualified. Filtration blanks should be less than the method specified limit, less than the PQL for the particulate samples, or less than 10% of the particulate sample concentrations, provided sample results are above the quantitation limit for the particular procedure.

5. REFERENCES

5.1. 3030 B. Filtration for Dissolved and Suspended Metals. Standard Methods for the Examination of Water and Wastewater. 20th Edition. 1998. p. 3-5.

5.2. BRL MPE004.

Exhibit A

BATCH FILTRATION LOG SHEET FOR PARTICULATE COLLECTION

Analyte(s): _____ Client ID(s): _____ Tech Initials: _____
 Filter Lot #: _____ Filter Size: _____ μm Date: _____
 Filter Cleaning Acid: HCl / HNO₃ (circle one or both) Acid Lot #(s): _____

SAMPLE ID NATIVE	SAMPLE ID PARTICULATE	START TIME	FINISH TIME	VOLUME FILTERED (mL)	NOTES/COMMENTS
Filtration Blank					

Page ____ of ____

Attachment 22

SOP SLA-New – Filtration of Large Volume Water Samples, Axys Analytical Ltd.

AXYS Analytical Services Ltd. Standard Operating Procedure

Title: Filtration of Large Volume Water Samples
Area: Laboratory Procedures

SOP #: SLA-New
Rev. No.: DRAFT
Date: 13 DEC-2007
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Purpose:

To filter large volumes of water through a 0.5 µm wound, glass fibre filter then through a 0.7µm paper filter. The procedure is commonly referred to as 'processing'.

Scope:

This SOP is applicable to large volume (>4<20 L) water samples, where the particulate is to be collected and analyzed and the filtrate (water) discarded. This procedure **is meant to replace in-situ field filtration techniques**.

Filtration is carried out by pumping the sample through a 0.5 µm wound, glass fibre filter then, in series, through a flat A/E glass filter. These procedures are an alternative to Millipore filtration. The filter(s) are subsequently Soxhlet extracted and analysed for the analytes of interest.

Materials and Reagents:

- Solvents – (acetone, toluene, dichloromethane, methanol) All solvents must be approved for use, as outlined in SLA-094, and documented in FQA-072. Analysts must ensure that the lot number of a specific solvent intended for use has been approved and is appropriate for the specific analytical method involved.
- Seastar water – (Seastar Chemicals, contaminant free) is used as received.
- Flat filters – 142mm A/E Glass flat filters. Baked before use as per SLA-010 Preparation of Filters for Field Use.
- Glass Fibre filters – 0.5µm wound. Cleaned and proofed according to SLA-102 and SLA-094 respectively.
- Filter holder – Stainless steel filter housing w/ Teflon coated silicone gasket
- Filter housing (as supplied by AXYS Technologies)
- 3/4" and 1/4" diameter Tubing/hoses – all tubing must be semi-rigid, thick walled, solvent rinsed FEP (Teflon) or Stainless Steel
- Fittings – all fittings and unions are stainless steel (SS) Swagelok or FEP compression

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nuts

- Wrenches: 18mm, 5/8", large and small spanners
- >250 mL graduated cylinder
- Graduated 23 L Carboy waste container
- Ungraduated 23 L Carboy waste container
- Trace Clean 23 L Carboy for use in QC samples
- Flow Meter
- Erlenmeyer Flask
- 4 L bottles with dipping hoses – one dipping hose with in-line large particle filter
- pink lab soap
- Swagelok gap measuring tool.
- Gear Pump – Cole-Palmer Micropump Gear Pump or equivalent

Any changes to the above equipment list must be reviewed and approved by the Technical Director.

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Procedures:

Filtration Procedures

Processing begins on day one with a blank consisting of 16 L of Seastar water. At the end of the processing period, an SPM is processed using 16 L of Seastar water. Processing a single sample takes approximately 2 hours.

Filtration/Elution

1. **SAMPLES MUST BE WARMED TO ROOM TEMPERATUE BEFORE PROCESSING BEGINS.** Samples should be removed from cool storage the previous day and stored at room temperature.
2. Decontaminate the system, see DECONTAMINATION OF SYSTEM
3. Place a clean 0.5µm wound filter and a 0.7µm flat filter in the appropriate filter holders. Connect the Filter Holders to the system. Ensure the flat filter holders are connected upside down. Refer to figure 1.
4. Place a waste carboy at the outlet of the system.
5. Place a clean sample dipping hose into an Erlenmeyer containing 2 L Seastar water, attach the dipping hose to the system. Open the valve and pump Seastar water through the system at approximately 250 mL/minute. When Seastar begins to elute from the flow meter column check the system for leaks and remedy as outlined in TROUBLESHOOTING.
6. Turn off the system and quickly close the valve.
7. At this point, the system is fully assembled. Pump Seastar water through the system and observe the flow meter. Use the speed dial on the gear pump to adjust the flow rate to 250 mL/min. At the beginning of a new processing batch, confirm the accuracy of the flowmeter using a 250 mL graduated cylinder and a stopwatch. The gear pump speed required for 250 mL/minute will gradually increase due to the gears wearing out. Conduct a final lead check on the system, TROUBLESHOOTING as necessary.
8. Replace the waste carboy with an empty graduated carboy.
9. Shake the sample thoroughly in its container.

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10. Remove the seal on the container.
11. Calculate the volume of the sample (see VOLUME CALCULATION)
12. Place the dipping hose into the sample and connect it to the system.
13. Open the valve and turn on the gear pump. Note the time.
14. Use the speed dial on the gear pump to adjust the flow rate to 250 mL/min. Conduct a final leak check on the system, TROUBLESHOOTING as necessary.
15. If any leaks or malfunctions appear that will require more than a moment to repair:
 - a) Close the valve.
 - b) Turn off the gear pump.
 - c) Resolve the issue.
16. Continue to monitor the progress of the system, ensuring
 - No leaks emerge.
 - The flow rate is 250 mL/min or less.
 - The dipping hose is submerged.
 - Any anomalies visible in the eluate are documented.
17. While the sample is being processed, prepare as much as possible for the next sample to minimize turn around time.
18. As nearly all the sample is processed, the sample container may need to be tilted to reach the remaining sample.
19. Allow the pump to operate until there is no water in the sample container and no water in the first portion of FEP tubing. Turn off the pump, close the valve and switch off the gear pump.

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20. Note the volume of wastewater in the carboy, this is the sample size. Discard the wastewater.
21. Disconnect the dipping hose and cover the end with foil. Leave the dipping hose inside the sample container during the next step.
22. Add Seastar water (1 L) to the original sample container and rinse the container thoroughly by rolling the water against the container wall. Avoid contacting the mouth of the container where the rubber seal touches.
23. Reattach the dipping hose and the sample container to the system and pump all the rinse water through the pump at 250 mL/min. Use the suction of the tubing to ensure all particulate matter and residual rinse water are pumped through.
24. Close the valve and turn off the gear pump. Disconnect the dipping hose from the system leaving it in the sample container. Cover with foil and set off to the side for rinsing as described in SOLVENT RINSE OF ORIGINAL CONTAINER.
25. Using a wrench, remove the flat filter holder from the pump. Open the flat filter holder. Using a spatula and forceps, remove the filter and place it on clean foil. Do not include the outside diameter of the filter punched off by the filter holder. Wrap the filter well in foil, label with the LIMS ID and client ID. Place the filter in a Ziploc bag and store at -20°C until just prior to extraction.
26. Using a wrench, open the cover from the wound filter housing and using a gloved hand and a large piece of aluminium foil, carefully remove the wound filter so as not to dislodge the particulate. Wrap the filter in the same piece of foil and then with another large piece and label with LIM and client IDs. Place the wound filter in the same Ziploc bag with the flat filter and store at -20°C until just prior to extraction.

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Solvent Rinse of Original Container

1. Rinse the dipping hose with DCM from a solvent squeeze bottle in to the sample container.
2. Remove the dipping hose.
3. Collect the dichloromethane rinse in a 1 L amber bottle. If the original container is a keg, remove the "In" fitting with a wrench and pour the rinse solvent out of the keg through the spigot.
4. Rinse the original sample container three times with 200 mL dichloromethane. Roll the solvent around in the container, contacting the entire inside surface of the container. Avoid contact with the mouth of the container where a rubber seal may have been.
5. Collect these rinses into the same bottle as the dipping hose rinse.
6. Label the bottle with the LIMS and client IDs, the date, analyst's initials and mark it as 2 of 2.

Decontamination of System

1. The system is decontaminated prior to the processing of each sample.
2. Carry out all solvent rinse procedures using the following solvent rinse sequence: acetone/toluene/dichloromethane/acetone.
3. Disconnect and solvent rinse the Dipping Hose.
4. Connect the tubing that leads to the XAD filter holder/housing to the tube leading to Waste carboy with a male-male connector.
5. Disconnect the filter holder and filter housing, if you've not already done so. Replace them with a male-male union. Connect to the male-male junction leading to the gear pump.
6. The system is decontaminated by flushing with detergent, tap water, Methanol then Seastar water (Figure 3). Each of the flushing solvents has its own separate dipping hose with the exception of the Seastar water which uses a clean sample dipping hose. The dipping hose for the detergent incorporates a stainless steel coarse filter to prevent soap granules from damaging the gear pump. The detergent solution is prepared by placing 2 or 3 scoops of pink lab soap into 4 L of tap water.

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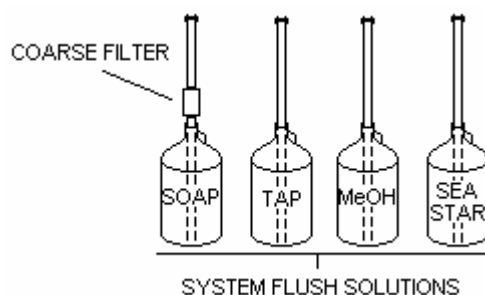


Figure 3: System Flush reagents

7. Flush the system with solutions in this order: Detergent, Tap Water, Methanol, Seastar water:
 - a. Close the valve.
 - b. Attach solution dipping hose.
 - c. Prime the system as described in PRIMING.
 - d. Open the valve.
 - e. Turn on the gear pump to a high speed and pump 2 litres of solution through the system. Be sure to collect methanol into solvent waste. Other waste solutions may be discarded into the sink.
 - f. Turn off the gear pump and quickly close the valve.
8. Disassemble the filter holder, do not remove the Teflon o-ring from the filter holder, it is very difficult to replace and will become damaged. Scrub all parts with detergent rinse with tap water then Seastar water. Solvent rinse the inside surface of the filter holder. Sonicate the Mesh, Teflon support ring and Teflon o-ring in 80:20 (toluene:acetone) for 20 minutes followed by solvent rinsing. Allow to air dry.
9. Disassemble the filter housing, scrub all parts with detergent and rinse with tap water then Seastar water. Solvent rinse the inside surfaces and ports leading to the FEP tubing and allow to air dry.

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Priming

1. Remove the cap nut from the priming access Union Tee.
2. Turn the valve to the open position
3. Use a squeeze bottle to squirt Seastar water into the tubing that leads to the gear pump.
The tubing may have to be tapped to remove air bubbles preventing water from entering the tube.
4. Replace the cap nut onto the Union Tee
5. The system is now primed and should generate enough suction to pull liquids up and out of their container.

Volume Calculation

The volume of sample in a keg is estimated using the formula for the volume of a cylinder:

The volume of a cylinder equals the (area of the base)*height = $\pi r^2 h$

The height of a keg is about 57 cm from bottom to lip. To estimate the height, measure the distance from the lip to the top of the sample inside the keg. Then subtract this from the total keg height to obtain the height of the sample in the keg.

The radius of a keg is about 10 cm.

For a sample that is 6 cm from the top of the keg:

$$\pi * 10^2 * (57 \text{ cm} - 6.0) = 15.3 \text{ L}$$

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Troubleshooting

All actions are conducted while system is not running

Filter holder leaking

1. The filter holder will leak by wicking from the filter. If leaking is significant (i.e. > 1 drip/ 30 seconds) troubleshoot.
2. Look for uneven spacing between the top cap and the canister, tighten the 3 screw pins.
3. Inspect the FEP encapsulated silicone O-ring for wear and flattening, replace with a new seal if necessary (AMD MFG#301906)).
4. If fittings to the filter holder are leaking, try using Teflon tape on the threads or flange of swage fitting.

Swagelok connections leaking

1. Some connections will have slow drips that cannot be remedied. If leaking is significant (>1 drip/30 seconds) then troubleshoot.
2. Tighten using two spanners, use the a Swagelok gap measuring tool to ensure proper tightening.
3. Disconnect the connection and look for signs of tearing on the teflon tube, excessive twisting and movement of the tubes may split the tubing.

Teflon compression joints leaking

1. Finger tighten nut
2. Inspect connection for cross threading, replacing parts if necessary
3. GENTLY tighten nut with ¼ turn of a spanner.

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Flow rate does not reach 250 mL/min at highest gear pump speed

1. Allow pump to cool if excessive heat noticed.
2. Ensure no tubing is pinched or blocked with matter.
3. While running tap gear head housing with handle of pliers, the gears may have worked loose.
4. Check pre-pump tubing for leaks, this will reduce suction from kegs.
5. If sample has high particulate check filter(s) and swap with a new one if necessary.
6. If sample is extremely muddy, a pre-filter packed with glass wool can be used to increase efficiency. The glass wool needs to be included in the filter composite.
7. The pump may have back pressure:
 - a. Disconnect and reconnect the tubing from the pump head
 - b. Open then close the flat 12 mm nut from the front of the gear pump
8. Disassemble the gear head and replace the gears using a Cole-Palmer 81287 Service Kit (00124ZE).

References

FWO-123	Water Filtration and XAD Extraction Worksheet
FWO-104	Sample Preparation Record
SLA-001	Cleaning of Laboratory Items
SLA-010	Glass filter preparation for field use
SLA-094	Proofing Laboratory equipment, sampling media, solvents
FQA-072	Proofed solvent lot numbers
FQA-075	Proofed sample container lot numbers

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SLA-102 Cleaning of Wound Glass Filter Cartridges

Approval

John Cosgrove, President and Senior Technical Director

Date

Dale Hoover, QA Manager

Date

Bill Warning, Director of Operations

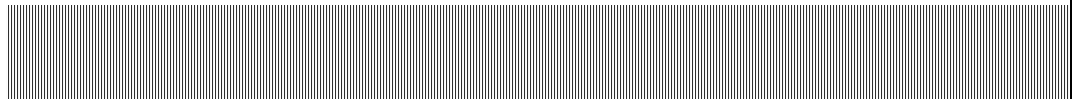
Date

U.S. Army Corps of Engineers – Kansas City District

601 East 12 Street
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USACE Contract W912DQ-06-D-0006, T.O. 0002

Fall 2007 Field Sampling Plan Addendum

December 2007



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**MALCOLM
PIRNIÉ**

R2-0012047

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1. Introduction

The sampling activities described in this Field Sampling Plan (FSP) Addendum are designed to support further evaluation of the Empirical Mass Balance Model (EMBM). This FSP is an addendum to the Lower Passaic River Restoration Project (hereafter referred to as the “Study”) Field Sampling Plan, Volume 1 (Malcolm Pirnie, Inc., 2006). Only applicable sections for the additional sampling activities are included in this FSP Addendum.

1.1. Site Background

The U.S. Environmental Protection Agency (USEPA), New Jersey Department of Environmental Protection (NJDEP), the U.S. Army Corps of Engineers (USACE), the New Jersey Department of Transportation (NJDOT), and the Trustees for Natural Resources have partnered to conduct a comprehensive study of the Lower Passaic River. The Study Area encompasses the 17-mile tidal reach of the Passaic River below the Dundee Dam, its tributaries (*e.g.*, Saddle River, Second River, and Third River), and the surrounding watershed that hydrologically drains below the Dundee Dam [refer to the Work Plan for a site location map (Malcolm Pirnie, Inc., 2005c)]. The Study is an integrated, joint effort among state and federal agencies that will take a comprehensive look at the problems within the Study Area and identify remediation and restoration options to address those problems. This multi-year study will provide opportunities for input from the public at all phases of development. The Study’s goals are to provide a plan to:

- Remediate contamination found in the river to reduce human health and ecological risks.
- Improve the water quality of the river.

- Improve and/or create aquatic habitat.
- Reduce the contaminant loading in the Passaic and the New York/New Jersey Harbor Estuary.

USEPA initiated work on the project using funds from the federal Superfund program. USEPA has also signed an agreement with over 70 companies (Cooperating Parties Group - CPG) for them to fund the Superfund portion of the joint Study. Congress provided the USACE-New York District with funds for the Water Resources Development Act (WRDA) study elements in the annual Energy and Water Development Appropriations Act. NJDOT is utilizing the funds from the New York/New Jersey Joint Dredging Plan and the Transportation Trust Fund to fulfill its contribution as local sponsor. As part of the study, the partnership will examine the best authorities to implement and fund the recommendations.

1.2. Conceptual Site Model

An initial conceptual site model (CSM) and methods to update the CSM were developed to examine the assumed sources of contaminants, routes of environmental transport, contaminated media, routes of exposure, and receptors. The CSM is presented in the document titled Conceptual Site Model (Malcolm Pirnie, Inc., 2007). Data gathered during the activities programmed in this FSP will be used to update the CSM, ultimately providing the basis to adapt and adjust future field data collection, and to evaluate and refine the EMBM. Additional geochemical and sediment stability analyses are currently being conducted to update the CSM and to provide guidance in determining future sampling locations for the sediment field programs described in this FSP. These geochemical and sediment analyses are listed below:

- Evaluation of historic changes in bathymetry.
- Evaluation of depositional record via radionuclide dating.
- Evaluation of historic sediment contaminant and physical properties data.

1.3. Sampling To Characterize External and Internal Sources of Contamination

The sediments of the Lower Passaic River have been and continue to be contaminated by external and internal sources. Data collected to date describe the current levels of contamination present in the sediments, but further data are desired to better refine the estimates of loads to the river. The sampling program described in this FSP Addendum aims to provide additional data that will characterize the external and internal sources of contaminants. Sources of contamination are to be evaluated inferentially through analysis and assessment of solids transported in the water column of the Lower Passaic River and its tributaries, recently-deposited surficial sediments, and solids (and potentially effluent) from Combined Sewer Overflow (CSO) and Stormwater Outfall (SWO) systems. In addition, further information is required to characterize sediment deposits above river mile 8 (RM8).

2. Field Activities

The field sampling activities for this study include the following elements:

Water Column Suspended Sediment Sampling on Tributaries and Upper Passaic River

- Sampling locations: Above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or at the Ackerman Avenue Bridge (RM17) on the Lower Passaic River]. Locations will generally correspond to the 2005 sampling locations for the Semi-Permeable Membrane Device (SPMD) deployments (Figure 1).
- Number of sampling events: Up to four sampling events plus two or three unscheduled events to capture a heavy rainfall. Total of six sampling events (plus Quality Assurance (QA)/ Quality Check (QC) samples).
- Sample collection technique: At each location, a suspended matter sample will be collected using the large volume water column sampling techniques tested by Malcolm Pirnie, Inc. in 2005, and as modified for this effort. A multi-probe sonde, or similar monitoring device, will be used to measure pH, temperature, dissolved oxygen (DO), redox (reduction/oxidation) potential and conductivity. Turbidity and flow will also be monitored during each sampling event.
- Sample analyses: Samples will be analyzed for Particulate Organic Carbon (POC), Total Suspended Solids (TSS), Polychlorinated Biphenyl (PCB) congeners, Polychlorinated Dibenzodioxins/Furans (PCDD/F), Polycyclic Aromatic Hydrocarbon (PAH), pesticides, and Target Analyte List (TAL) metals including mercury and titanium.

Sediment Sampling on Tributaries, Upper Passaic River, and Lower Passaic River

Recently-Deposited Surface Sediment Sampling on Tributaries and Upper Passaic River:

- Sampling locations: Above the head of tide on Saddle River, above the head of tide on Second River, above the head of tide on Third River, and above Dundee Dam in the Upper Passaic River [or upriver of the Ackerman Avenue Bridge RM 17 on the Lower Passaic River]. Locations will be within the vicinity of the 2005 sampling locations for the SPMD deployments (Figure 1).
- Sample collection technique: At each location, a surface sediment sample will be collected using either a short-coring device, piston core, or an Ekman dredge. Samples will represent a sediment depth of 0-1 inch and have sufficient mass for the analysis of the suite of parameters listed below.
- Sample analyses: Each sample will be initially analyzed for beryllium-7 (Be-7), cesium-137 (Cs-137), potassium-40 (K-40), Total Organic Carbon (TOC), grain size, and TAL metals including mercury and titanium. Selected samples that have detectable quantities of Be-7, representing a modern depositional environment, will be subsequently analyzed for PCB congeners, PCDD/F, PAH, and pesticides.

Recently-Deposited Surface Sediment Sampling on the Lower Passaic River:

- Sampling Locations: Sampling will be conducted at up to 20 locations that correspond to 2005 Be-7 field reconnaissance locations that were found to contain detectable levels of Be-7. Figures 2-1 through 2-12 of Appendix A - FSP Addendum show target areas and existing Be-7 sample locations, which served as a guide to locate the 20 proposed surface sediment locations. The 20 sampling locations will be finalized based on probing and existing information regarding Be-7 sample locations, as shown in Figures 2-1 through 2-12.
- Sample collection technique: At each location, a surface sediment sample will be collected using either a short-coring device, piston core, or an Ekman dredge. Samples will represent a sediment depth of 0-1 inch and have sufficient mass for the analysis of the suite of parameters listed below.

- Sample analyses: Each sample will be initially analyzed for Be-7, Cs-137, K-40, TOC, grain size, and TAL metals including mercury and titanium. Eight samples that have detectable quantities of Be-7, representing a modern depositional environment, will be subsequently analyzed for PCB congeners, PCDD/F, PAH, and pesticides.

Combined Sewer Overflow (CSO)/ Stormwater Outfall (SWO) Sampling

CSO “Regulator” Overflow Large Water Column Sampling:

- Sampling locations: 8 sampling (Figures 4-1 and 4-2). These 8 locations were chosen based on the following:
 - The CSOs drain to the Passaic River
 - Total area contained in the ‘sewershed’ (*i.e.*, the size of the sewage drainage area) is of sufficient size
 - Safe access to the CSO manhole (*i.e.*, not in the middle of the road)
 - Access to the outfall manhole for the regulator side of the system.
 - Engineering drawings provided by PVSC
- Number of sampling events: Sampling will be conducted during 4 rainfall sampling events, if possible. For each event, 4 locations will be sampled.
- Sample collection technique: At each location, large volume water samples will be collected using a peristaltic pump. Total number of samples for the CSO sampling will be a maximum of 16 samples (4 events × 4 locations) plus QA/QC samples. A multi-parameter sonde, or similar monitoring device will be used to measure pH, temperature, DO, redox potential and salinity (salinity will be used to determine if river water has been purged from the system during discharge).
- Sample analyses: Each sample will be analyzed for TOC, grain size, PCB congener, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The laboratories will perform the filtration of the grab water sample.

SWO Sampling:

- Sampling locations: 8 to 10 sampling locations, if possible. Figure 4-3 shows the location of the SWO outfalls that discharge to the Passaic River identified during the first field reconnaissance. Further field reconnaissance and an assessment of the engineering drawing provided by PVSC will be performed to finalize the selection of the SWO sampling locations. The selection of the SWOs will be based on the following:
 - The SWOs drain to the Passaic River
 - Total acreage of the drainage area
 - Safe access to the SWO manhole (*i.e.*, not in the middle of the road)
 - Permission from the Township
- Number of sampling events: Sampling will be conducted during 4 rainfall sampling events, if possible. For each event, 4 locations will be sampled.
- Sample collection technique: At each location, large volume water samples will be collected using a peristaltic pump. Total number of samples for the SWO sampling will be a maximum of 16 samples (4 events \times 4 locations) plus QA/QC samples. A multi-parameter sonde, or similar monitoring device will be used to measure pH, temperature, DO, redox potential and salinity (salinity will be used to determine if river water has been purged from the system during discharge).
- Sample analyses: Each sample will be analyzed for TOC, grain size, PCBs, PCDD/F, PAHs, pesticides, and TAL metals plus titanium and mercury on the suspended solids. The laboratories will perform the filtration of the grab water sample.

Supplemental Sediment Coring (Above RM 8)

- Sampling locations: Up to 20 sampling locations have been selected, three of which correspond to the previous Sedflume core locations, with the remainder of the samples to be collected within fine-grained sediment deposits determined from the

field reconnaissance probing that will be performed at the beginning of the field activities (Figures 3-1 and 3-2).

- **Sample collection technique:** At each location a sediment core will be collected using a piston-coring device, as practicable. Samples are to be sub-sampled into two intervals defined as 0-6 inches (below the sediment/water interface) and 6 inches to refusal or the presence of underlying red-brown clay/dark reddish brown silty-sand, whichever comes first. Samples will be used to characterize the contaminant inventories of the fine-grained sediment lenses above RM 8; the top six inch interval is considered the most likely to erode during a high-flow event. Samples should have a sufficient mass for the analysis of the suite of parameters listed below.
- **Sample Analyses:** Each sample will be analyzed for TOC, grain size, PCB Aroclors, PCDD/F, PAHs, pesticides, and TAL metals including mercury and titanium.

2.1. Site Facilities

The field facility, staging areas and sampling/survey vessel floating dock are located at the Kelways Industrial Park in East Rutherford. The field facility sample management and processing space is a 650 square-foot storage/garage unit with 20-ft ceilings and two roll-up garage doors. The space is located about 200 yards from the east bank of the Passaic River at approximately RM13.5.

2.2. Health and Safety

FSP field tasks will be conducted in accordance with the site-specific Health and Safety Plan (HASP; Malcolm Pirnie, Inc., 2005d) and addenda, prepared in accordance with the Occupational Safety and Health Administration (OSHA) requirements contained in 29 Code of Federal Regulations (CFR) 1910 including the final rule contained in 29 CFR 1910.120. The procedures are also consistent with the guidance contained in the following documents:

- OSHA Guidance Manual for Hazardous Waste Site Activities [prepared jointly by the USEPA, National Institute for Occupational Safety and Health (NIOSH), OSHA, and the U.S. Coast Guard (USCG)];
- USACE Safety and Health Requirements Manual, Engineering Manual (EM) 385-1-1 (USACE, 2003).

2.3. Equipment Decontamination

A description of equipment decontamination facilities and sequential decontamination procedures for non-dedicated equipment are provided as Standard Operating Procedure (SOP) 7 – Decontamination of Water Sampling Equipment (Malcolm Pirnie, Inc., 2005a) in the Attachment to the QAPP Addendum.

2.4. Sample Management and Preservation

Sample management will follow the SOP 1 - Procedure to Conduct Sample Management for CLP and non-CLP Samples (Malcolm Pirnie, Inc., 2005a) attached to the QAPP. To maintain sample integrity prior to the analysis in the laboratory, samples collected will be preserved following SOP 2 - Procedures to Conduct Sample Preservation (Malcolm Pirnie, Inc., 2005a), also attached to the QAPP,

2.5. Standard Operating Procedures

SOPs needed for these field activities are provided as attachments in the QAPP Addendum. (SOPs that have not yet undergone agency review include SOP 24, and SOPs 50 through Sop 54.) The following SOPs are included:

- SOP 1 - Procedure to Conduct Sample Management for CLP and non-CLP Samples
- SOP 2 - Procedure to Conduct Sample Preservation
- SOP 3 - Procedure to Conduct a Technical System Field Audit
- SOP 4 - Procedure to Locate Sample Points Using a Global Positioning System (GPS)
- SOP 7 - Decontamination of Water Sampling Equipment

- SOP 8 - Procedure for Sediment Probing
- SOP 20- Ultra-clean Water Sampling Procedures for Mercury
- SOP 21 - Procedure for use of Horiba for measuring Water Parameters
- SOP 22 - Management and Disposal of Investigation Derived Waste
- SOP 24 - Collecting Surface Sediments Using an Ekman or Ponar Dredge
- SOP 50 - Hand Coring Devices
- SOP 51 - Trace Organics Platform Sampler (TOPS)
- SOP 52 - Field Filtration of Suspended Solids from Waters
- SOP 53 - Core Processing-Low Resolution Cores
- SOP 54 - Collection of Water Outflow Samples
- SOP #BR-0107 – Filtration for Collection of Particulate from Water Samples,
Brooks Rand Labs
- SOP SLA-New - Filtration of Large Volume Water Samples, Axys Analytical Ltd.

3. References

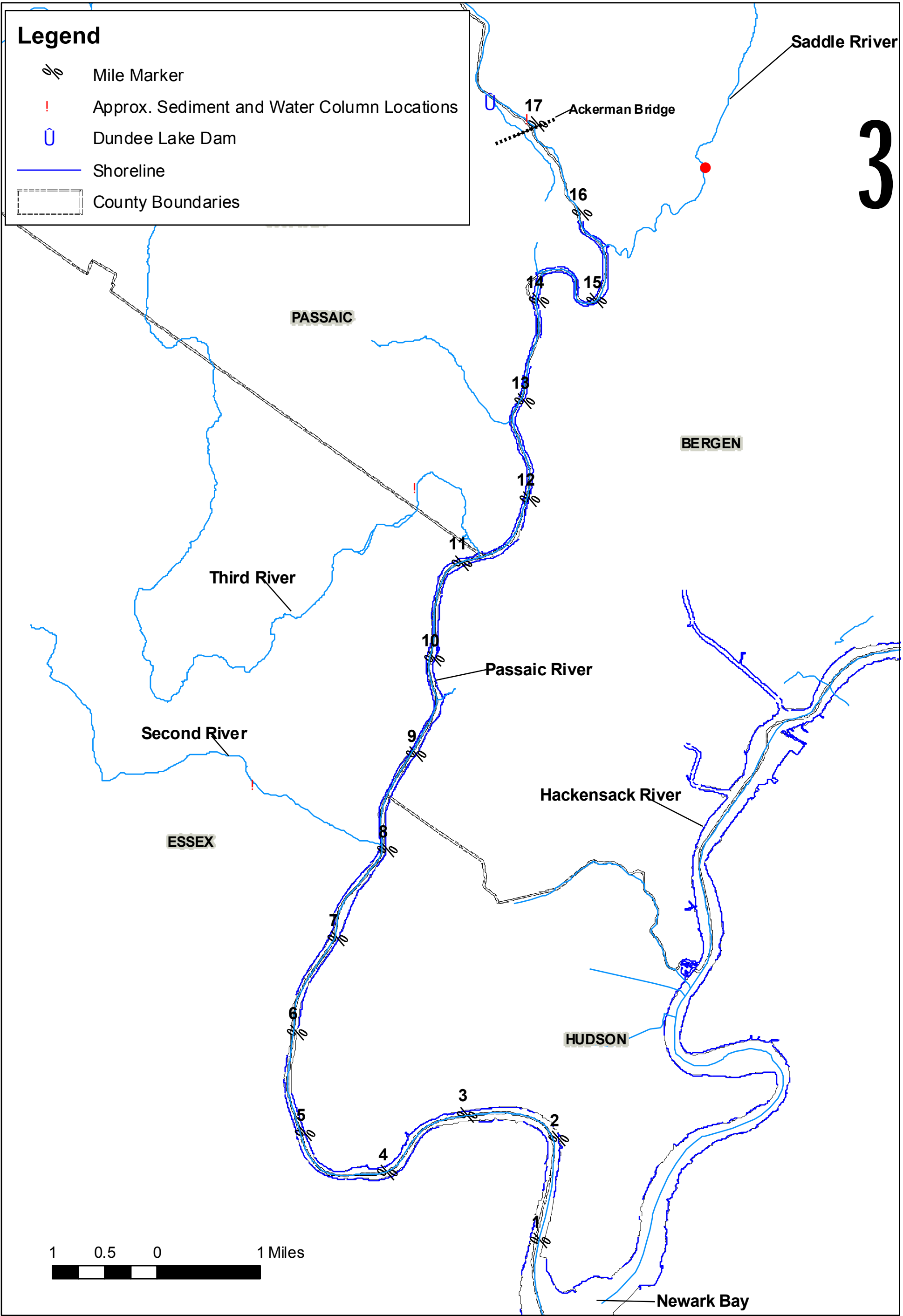
Malcolm Pirnie, Inc. 2006. Field Sampling Plan: Volume 1, Lower Passaic River Restoration Project. Prepared in conjunction with Battelle, and HydroQual, Inc. January 2006.

Malcolm Pirnie, Inc. 2005a. Quality Assurance Project Plan, Lower Passaic River Restoration Project. Prepared in conjunction with Battelle and HydroQual, Inc. August 2005.

Malcolm Pirnie, Inc. 2005c. Health and Safety Plan, Lower Passaic River Restoration Project. Prepared in conjunction with Battelle and HydroQual, Inc. January 2005.

Malcolm Pirnie, Inc. 2007. Conceptual Site Model, Lower Passaic River Restoration Project.

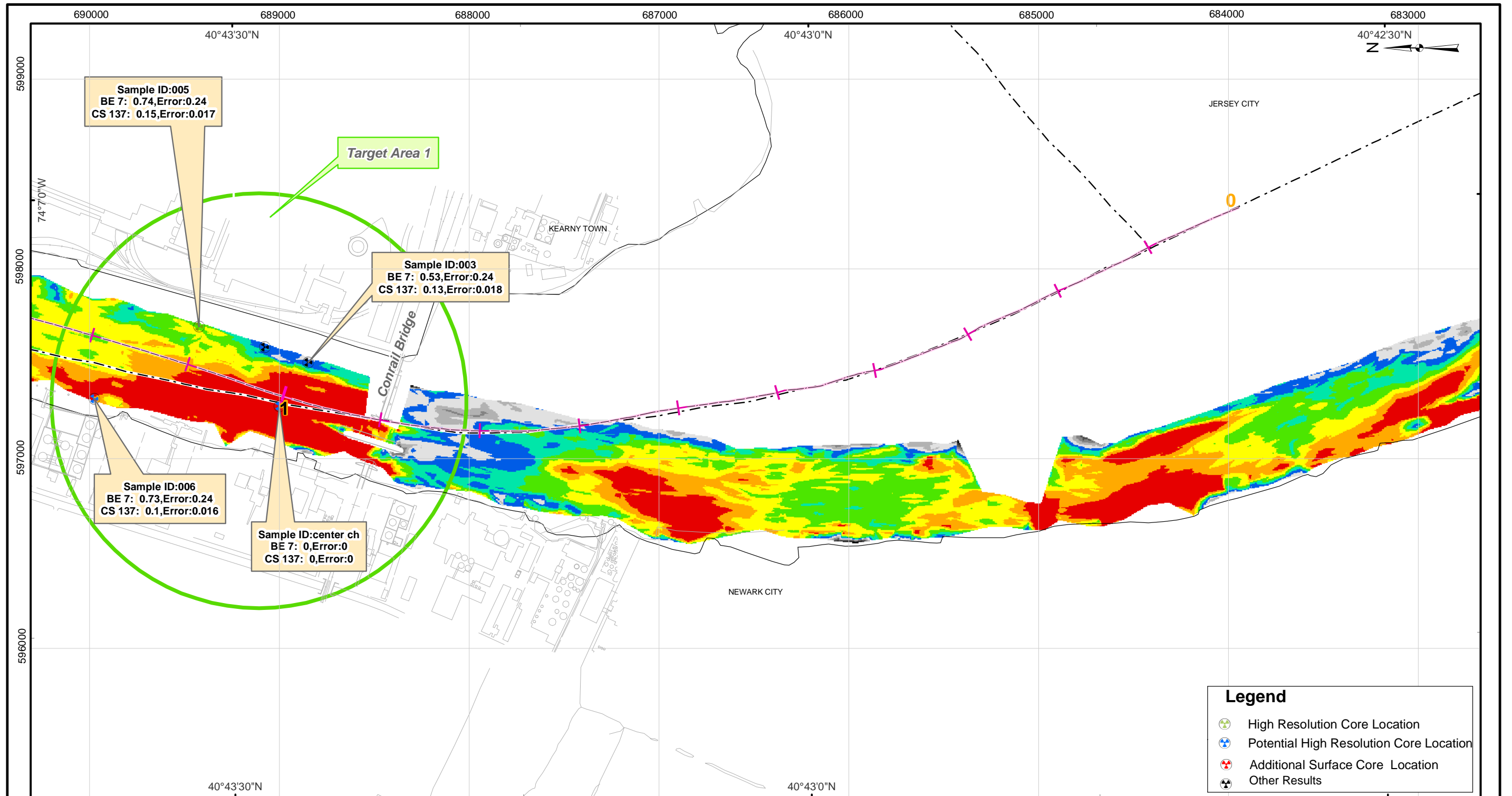
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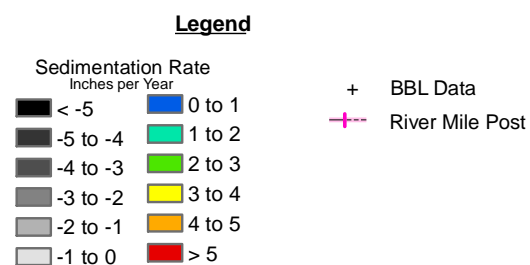
Lower Passaic River Superfund Site
Approximate Sediment and Water Column Sampling Locations

Figure 1

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Lower Passaic River
Restoration Project
New Jersey
**Sedimentation Rate
(1989-2004)**

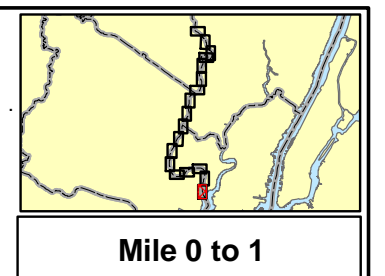


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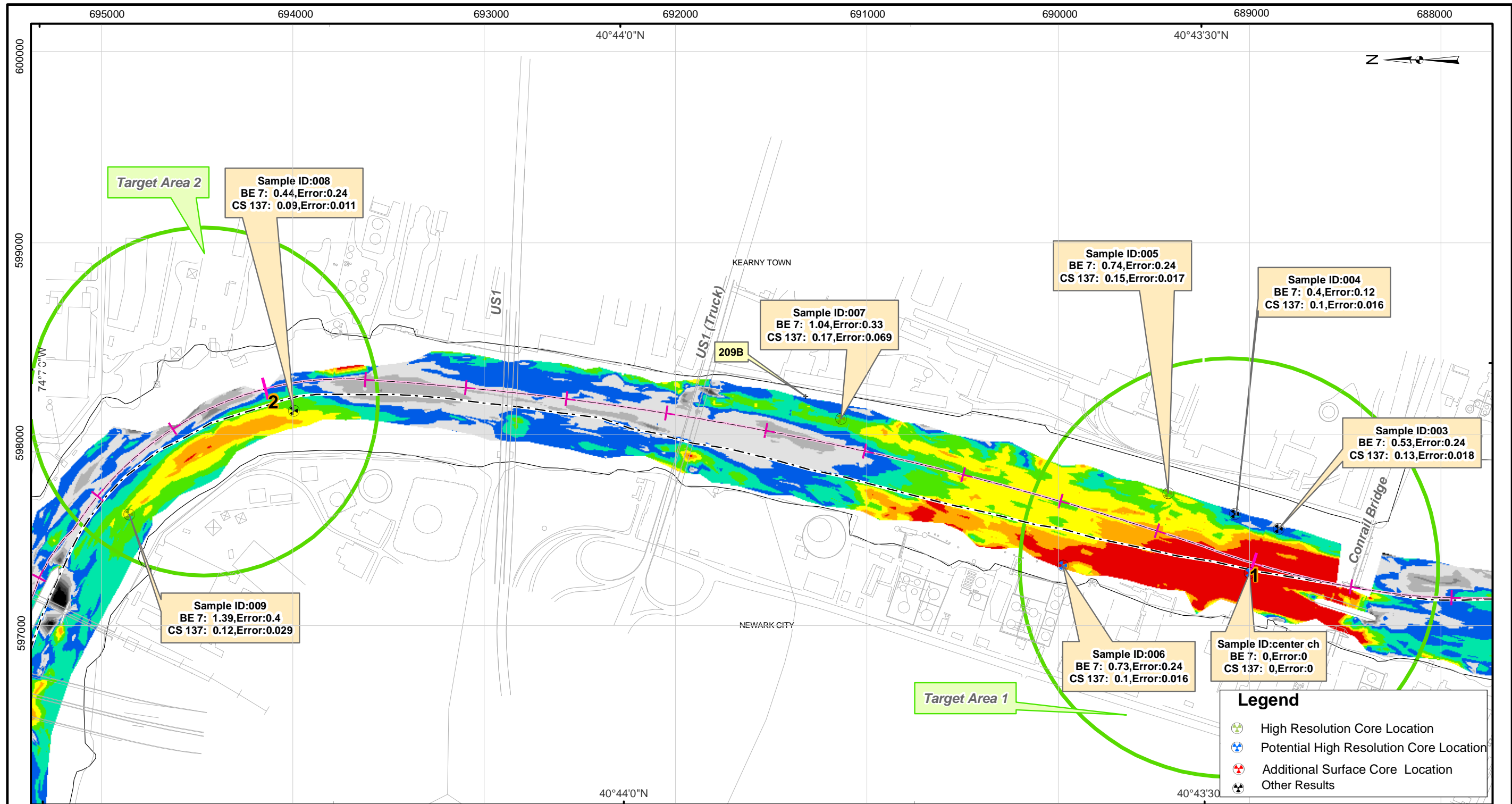
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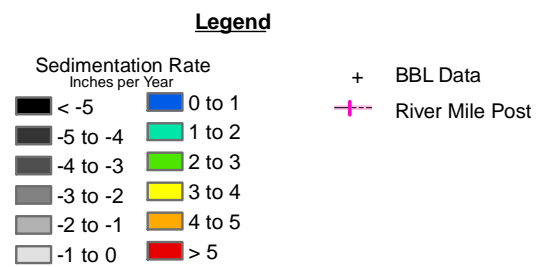
Figure 2-1



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Lower Passaic River Restoration Project New Jersey Sedimentation Rate (1989-2004)

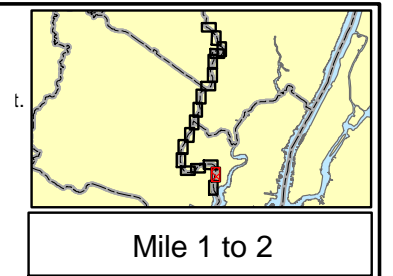


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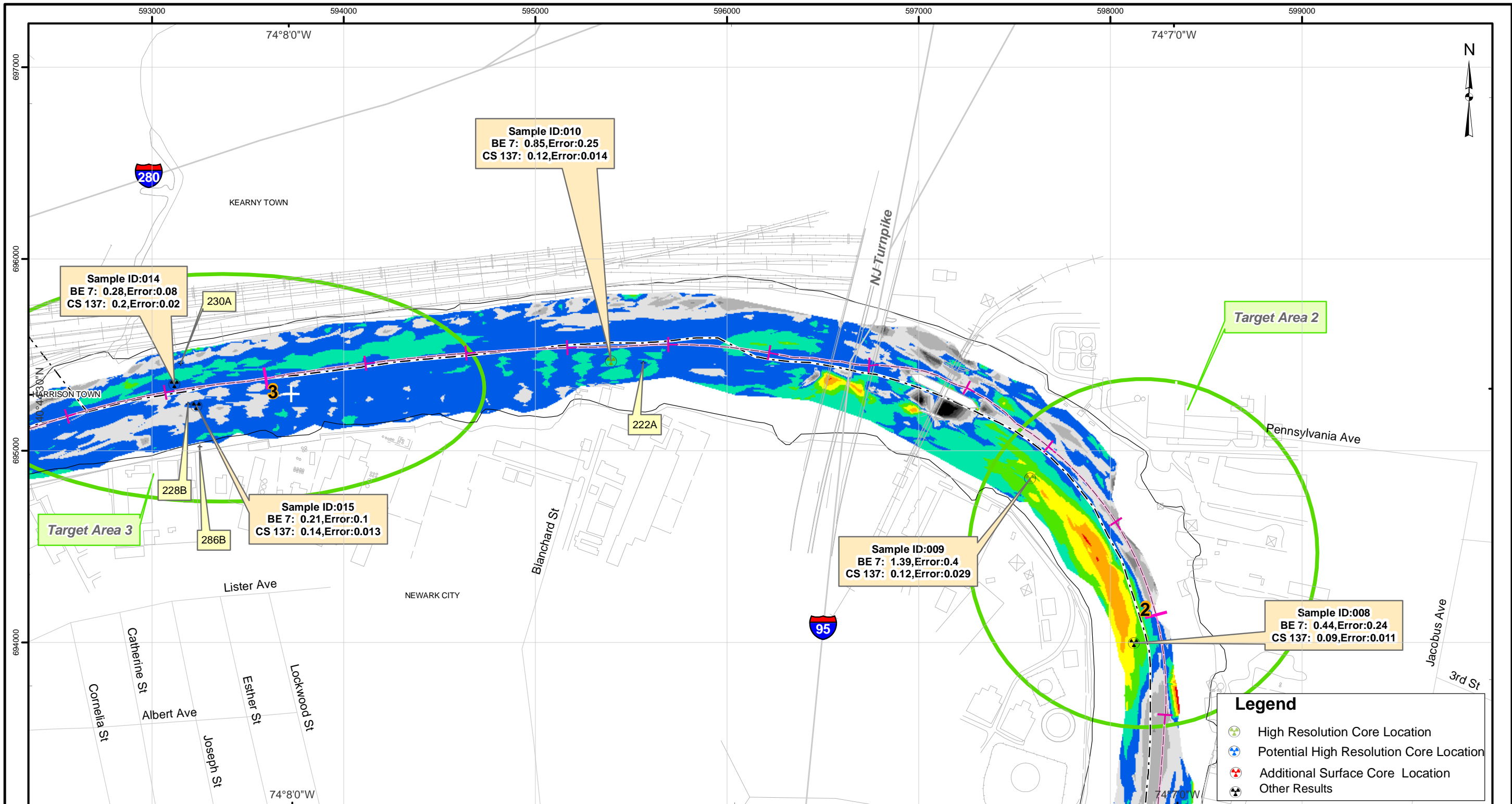
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Figure 2-2



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Lower Passaic River Restoration Project New Jersey Sedimentation Rate (1989-2004)



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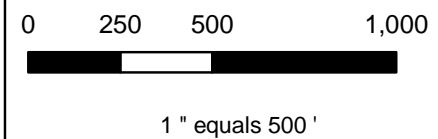
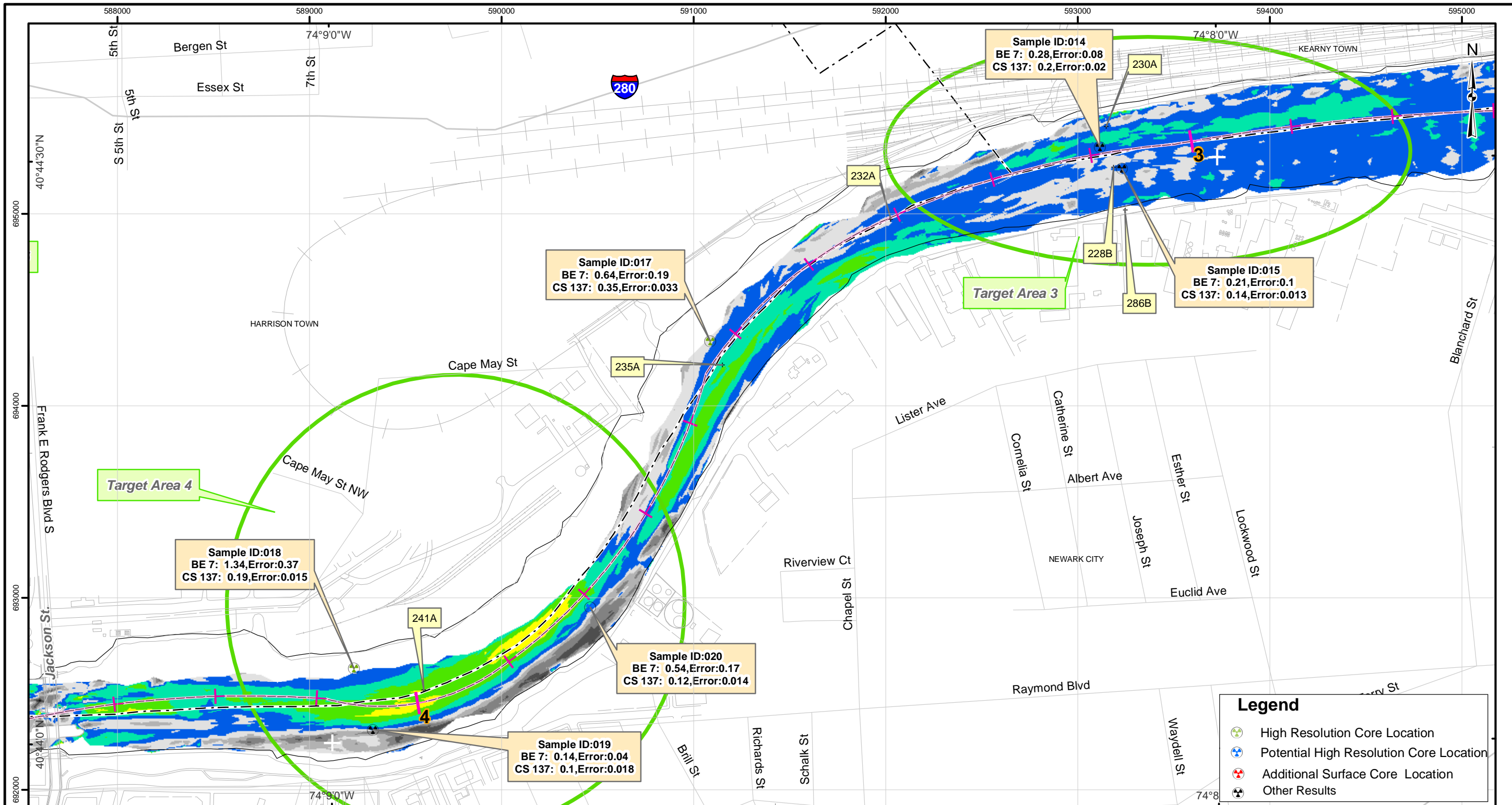


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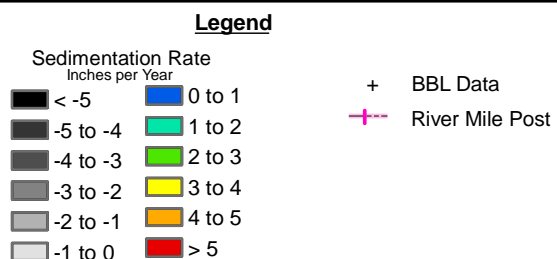


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Lower Passaic River
Restoration Project
New Jersey
**Sedimentation Rate
(1989-2004)**



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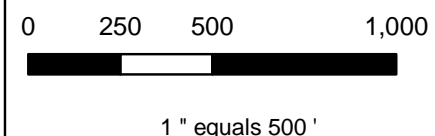
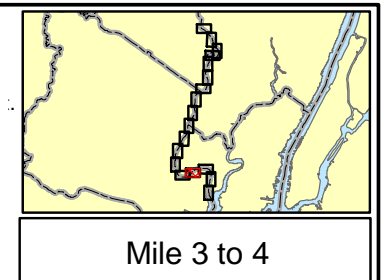
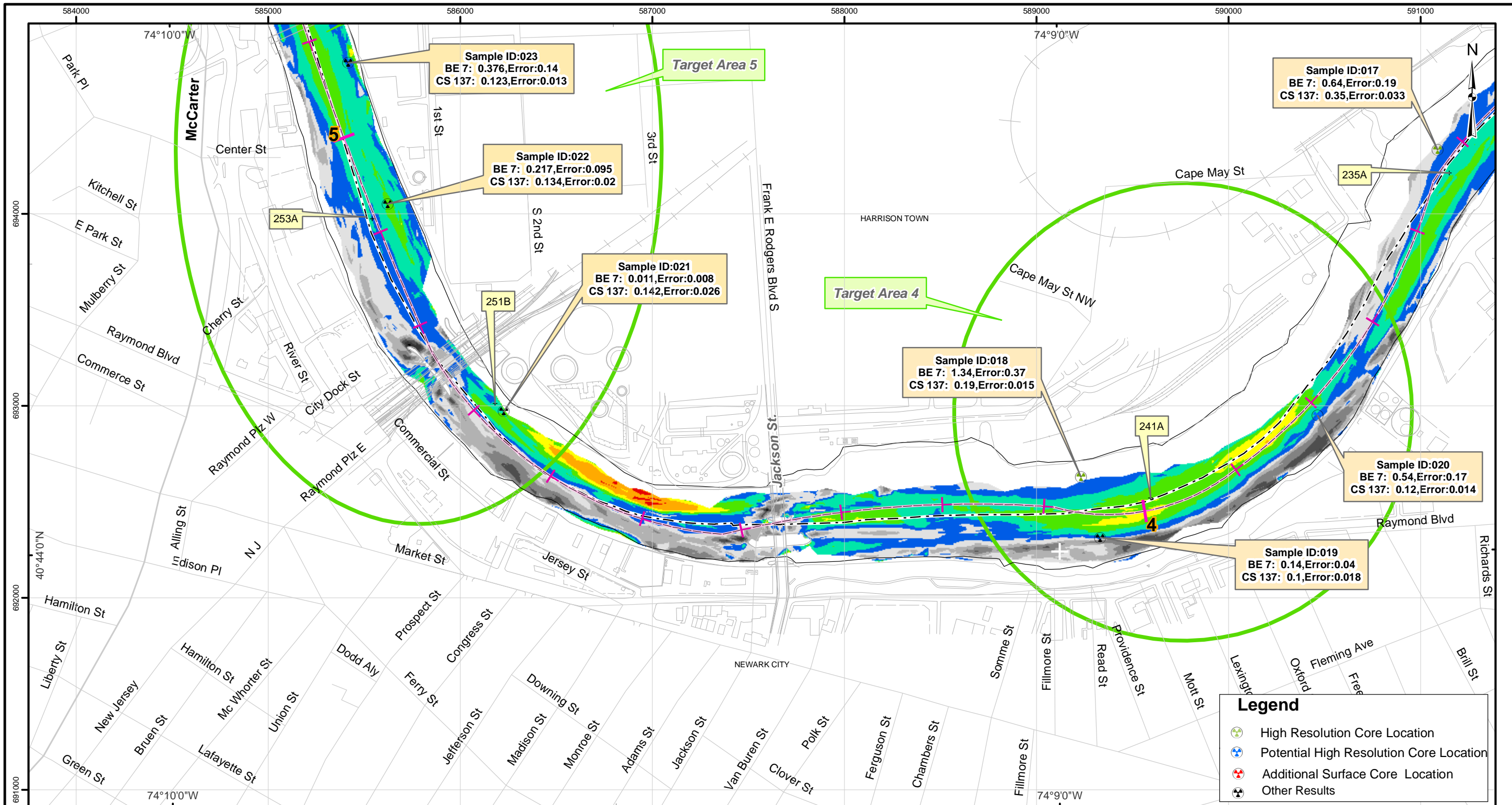


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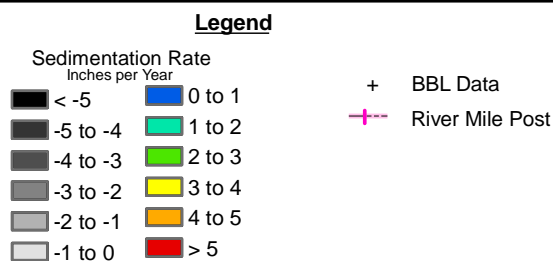


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Lower Passaic River Restoration Project New Jersey Sedimentation Rate (1989-2004)



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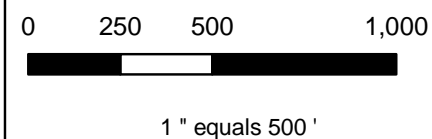
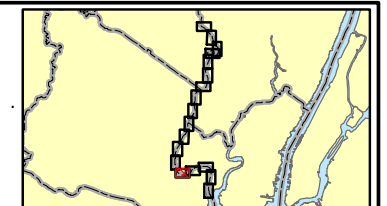
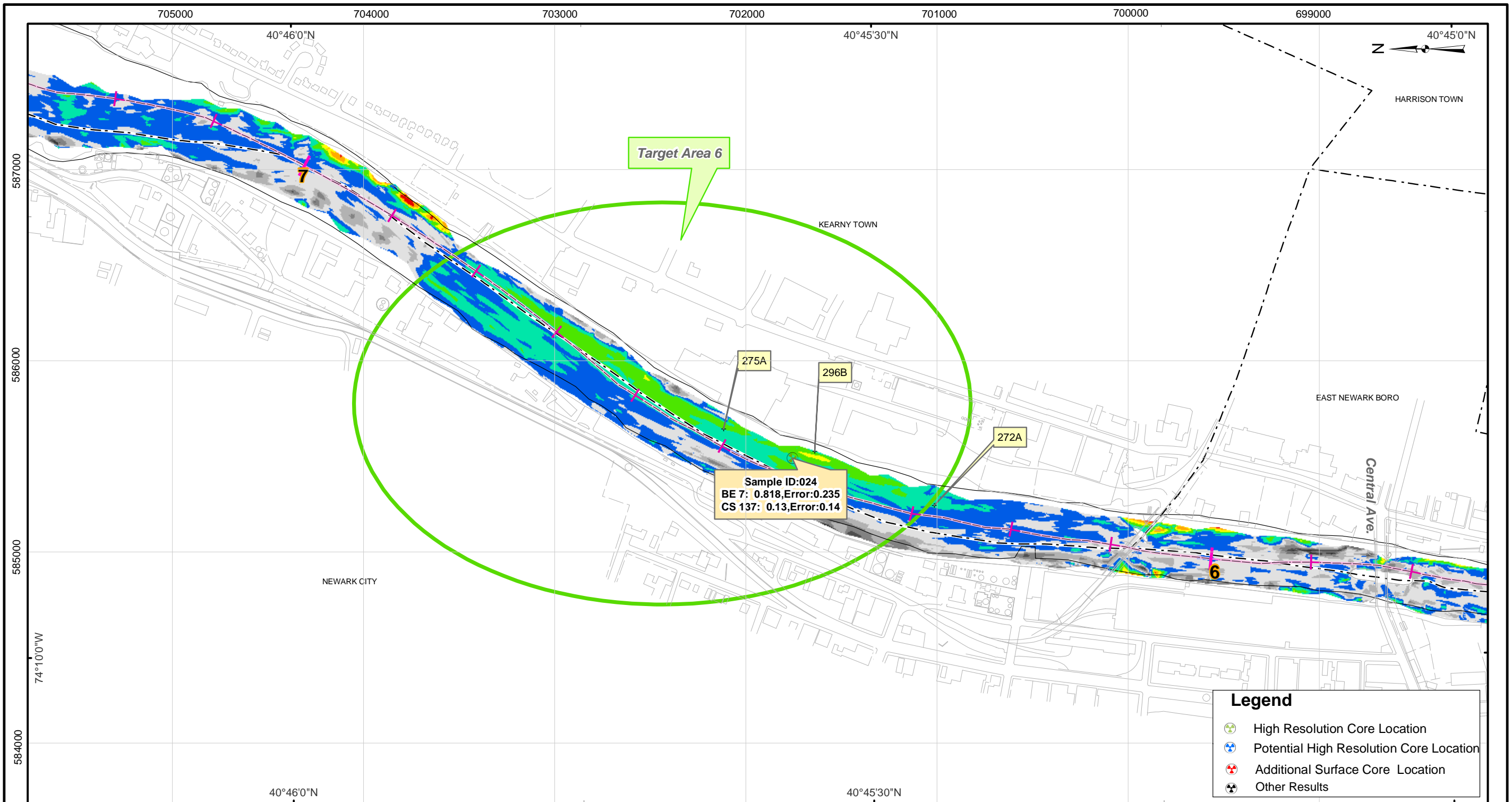


Figure 2-5



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Legend

- High Resolution Core Location
- Potential High Resolution Core Location
- Additional Surface Core Location
- Other Results



Lower Passaic River
Restoration Project
New Jersey
**Sedimentation Rate
(1989-2004)**

Legend

Sedimentation Rate
Inches per Year

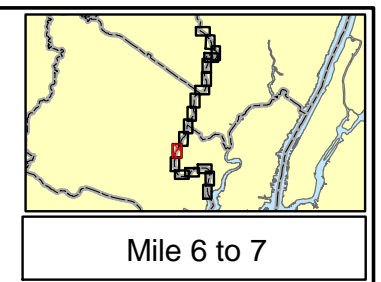
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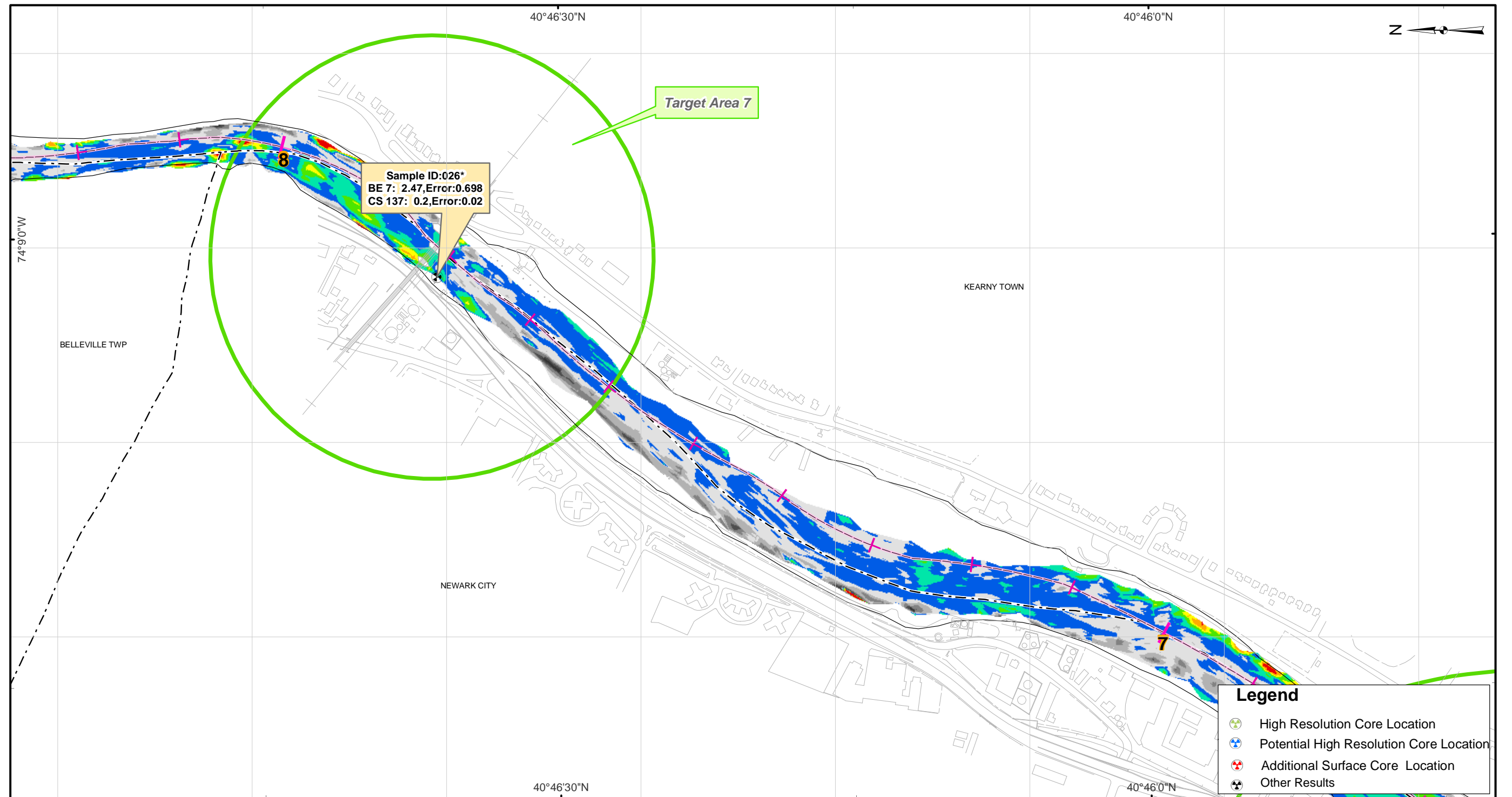
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Figure 2-6



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Lower Passaic River
Restoration Project
New Jersey
**Sedimentation Rate
(1989-2004)**



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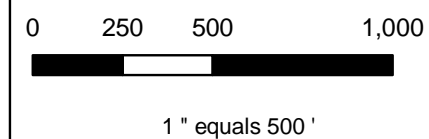
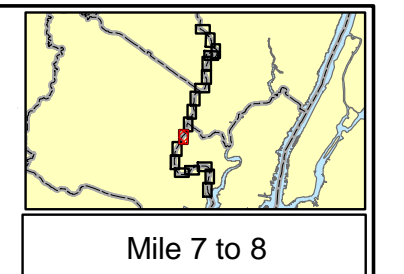
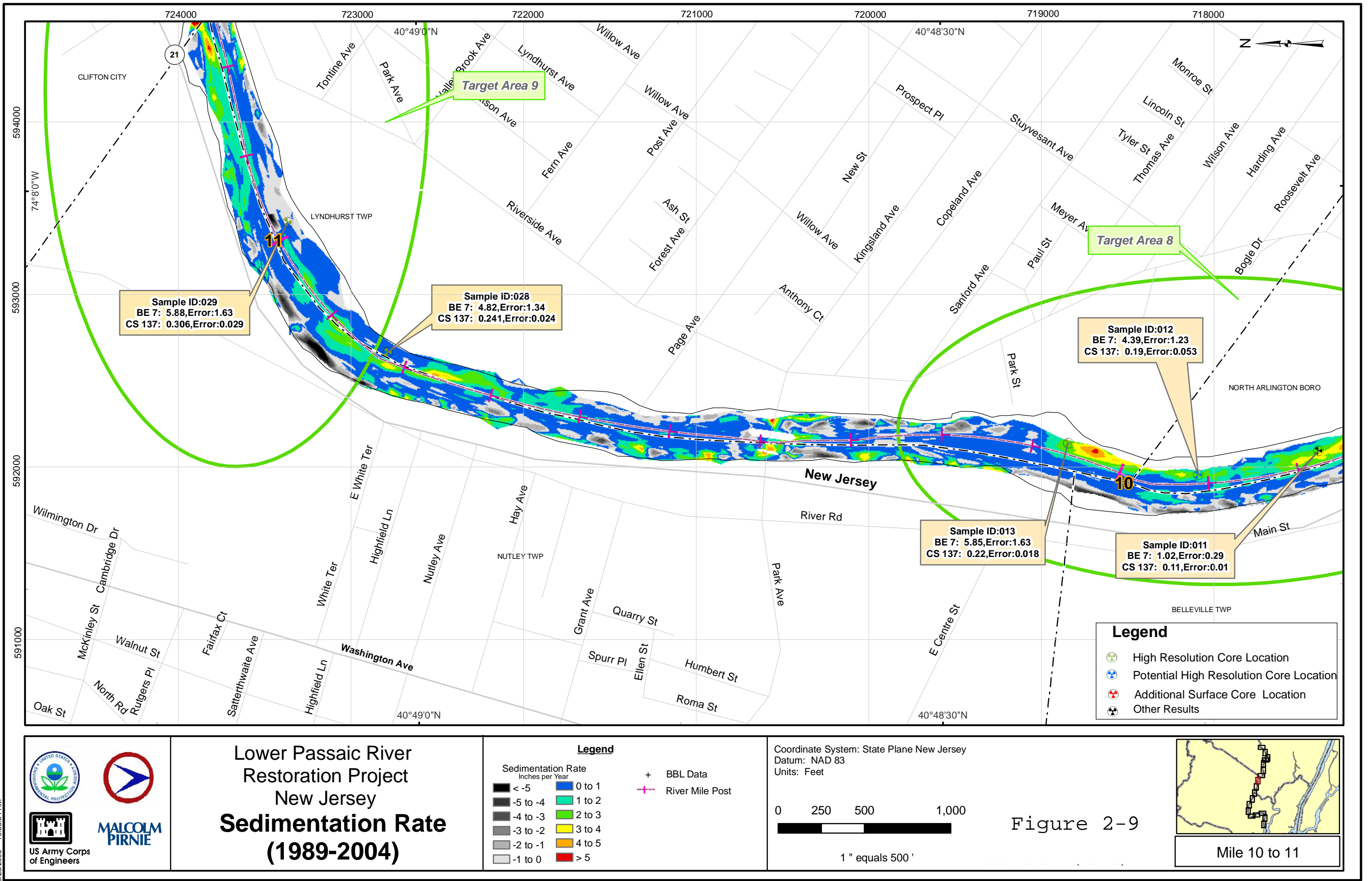


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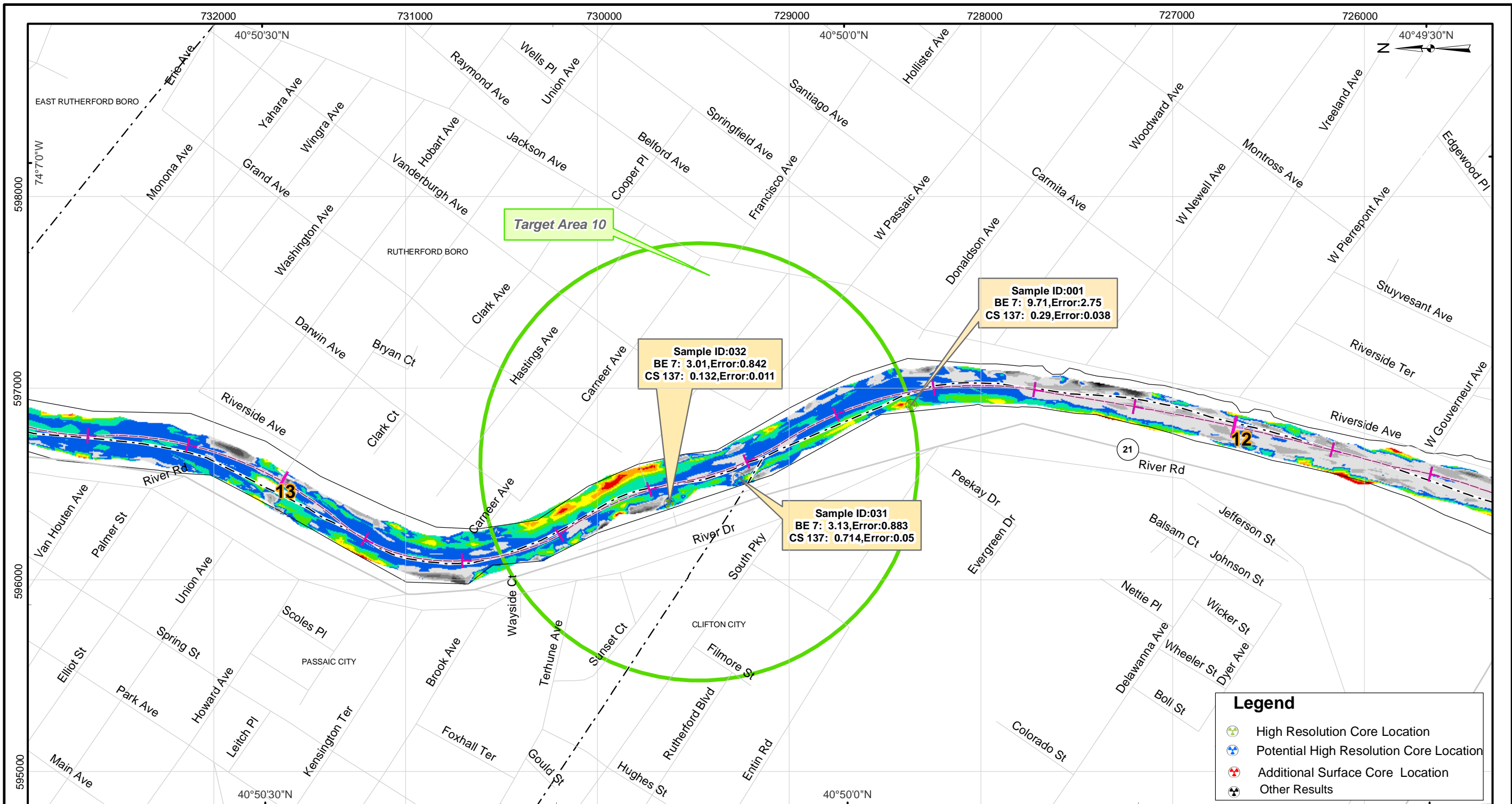


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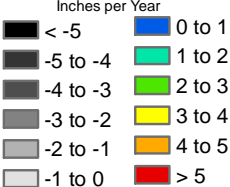
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Lower Passaic River Restoration Project New Jersey Sedimentation Rate (1989-2004)

Legend

Sedimentation Rate
Inches per Year



+ BBL Data
+ River Mile Post

Coordinate System: State Plane New Jersey
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Units: Feet

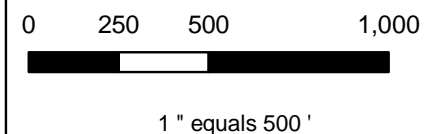
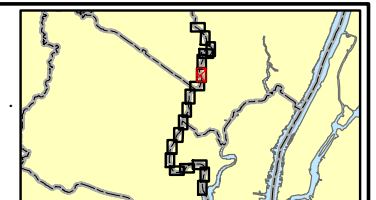
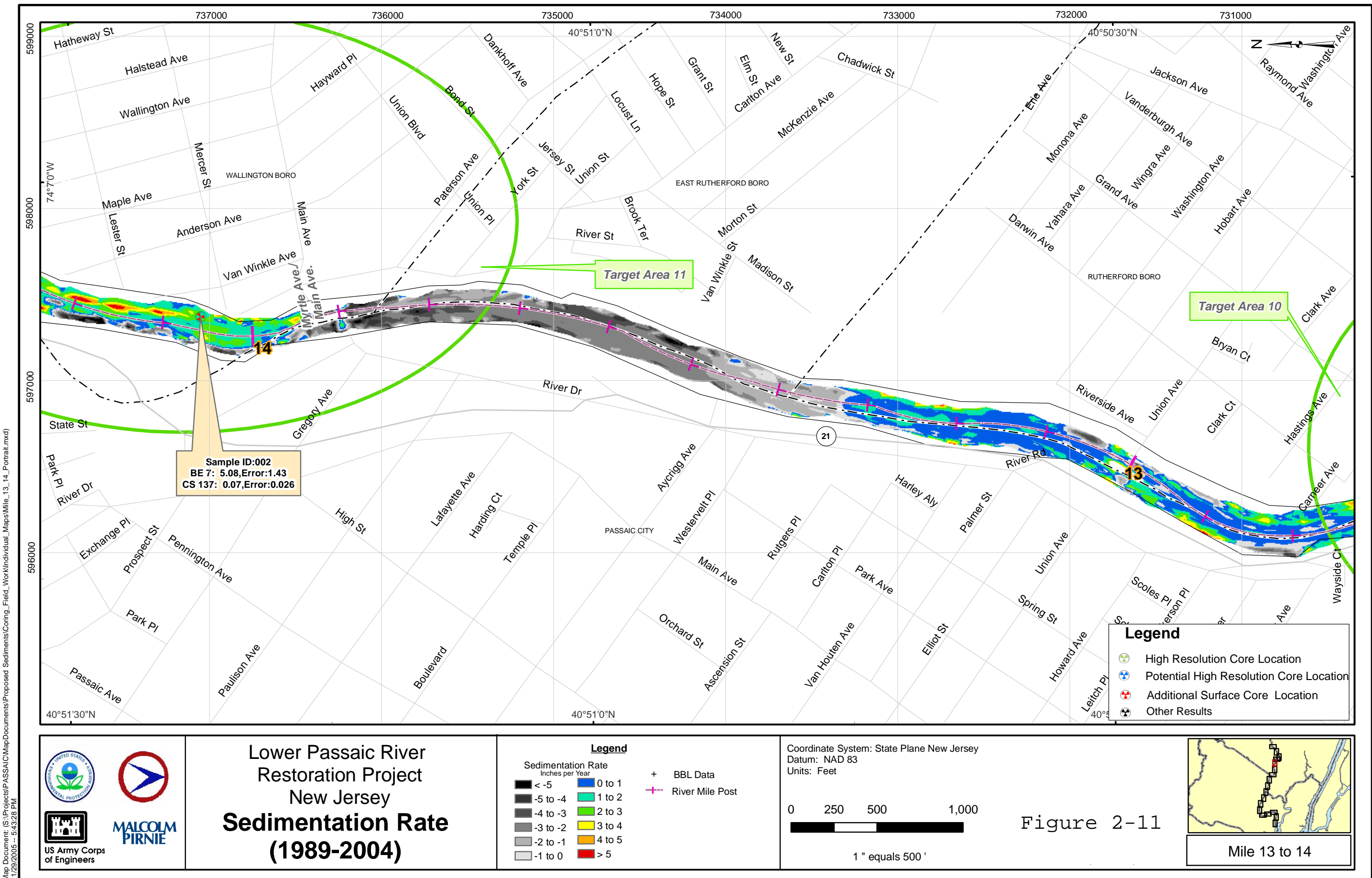


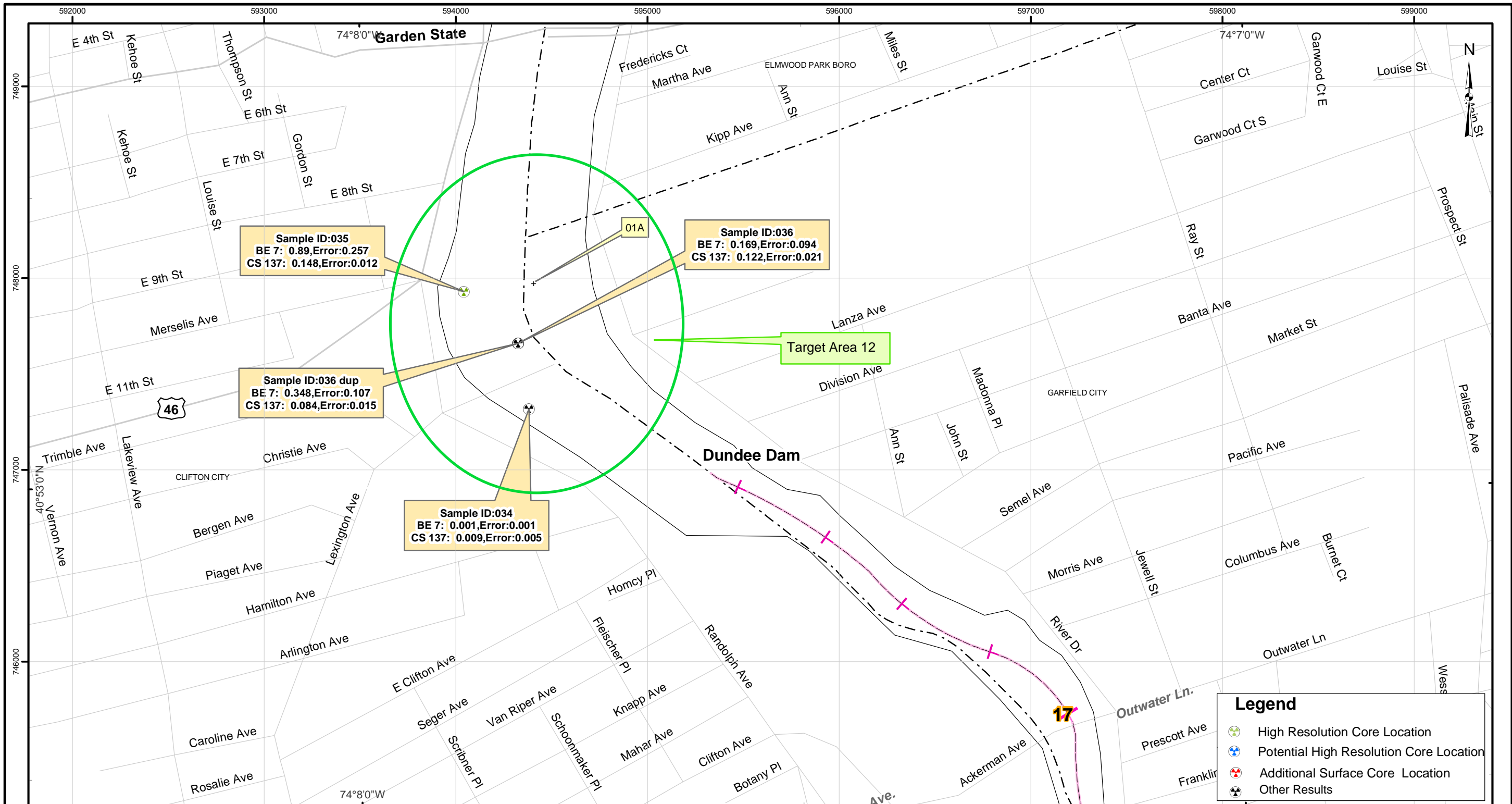
Figure 2-10



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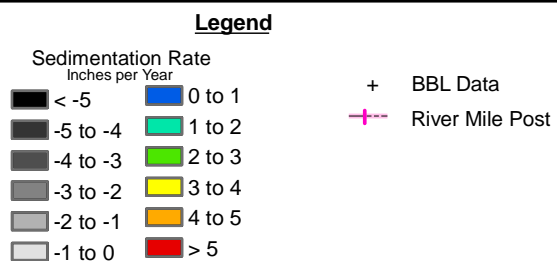


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Lower Passaic River Restoration Project New Jersey Sedimentation Rate (1989-2004)



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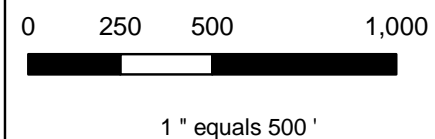
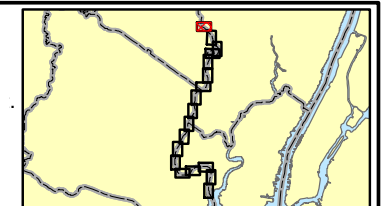


Figure 2-12



Mile 17 to Dundee Dam

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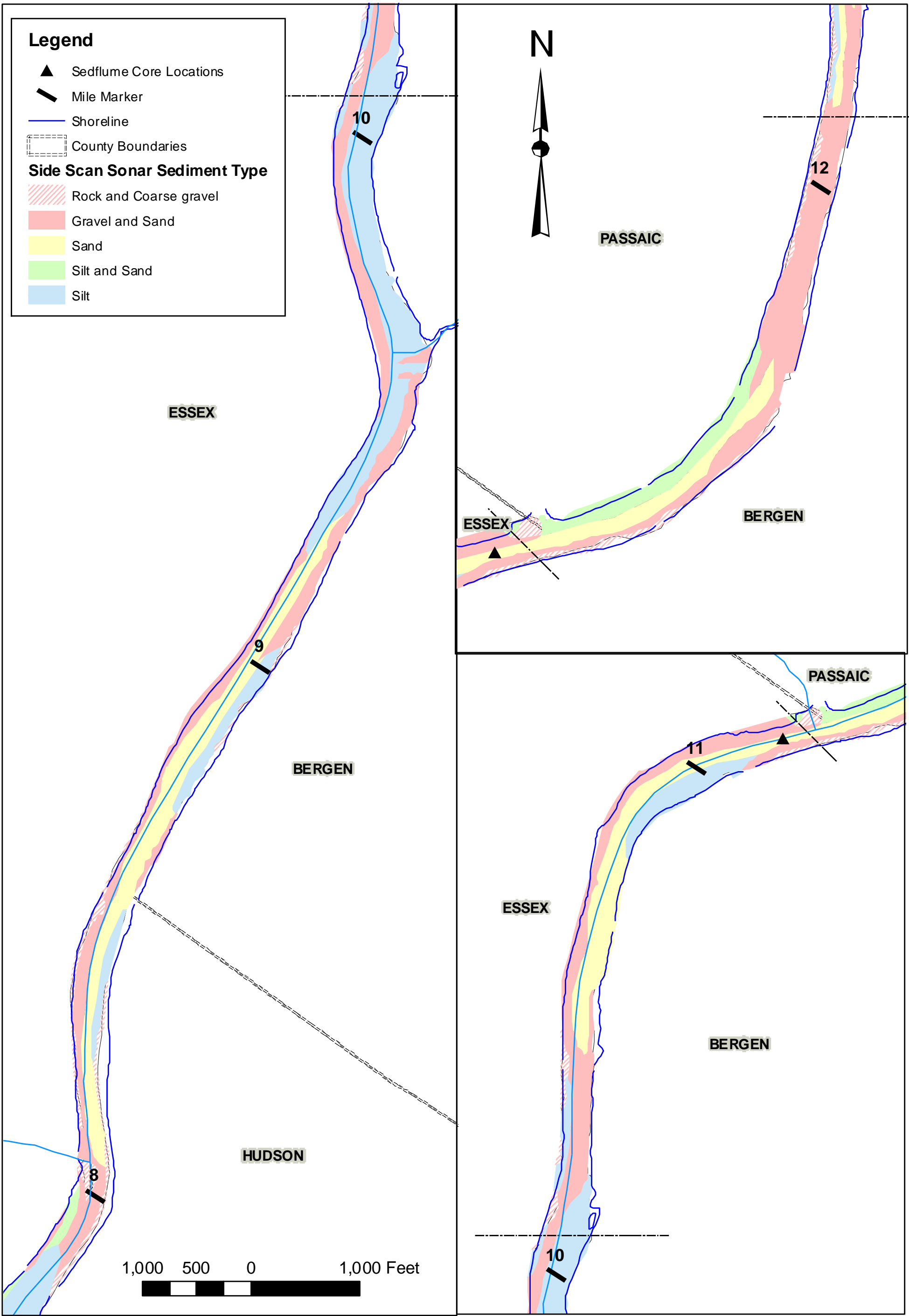


Figure 3-1
Lower Passaic River Restoration Project
Side Scan Sonar Sediment Type Above RM8 to Identify Supplemental Sediment Cores



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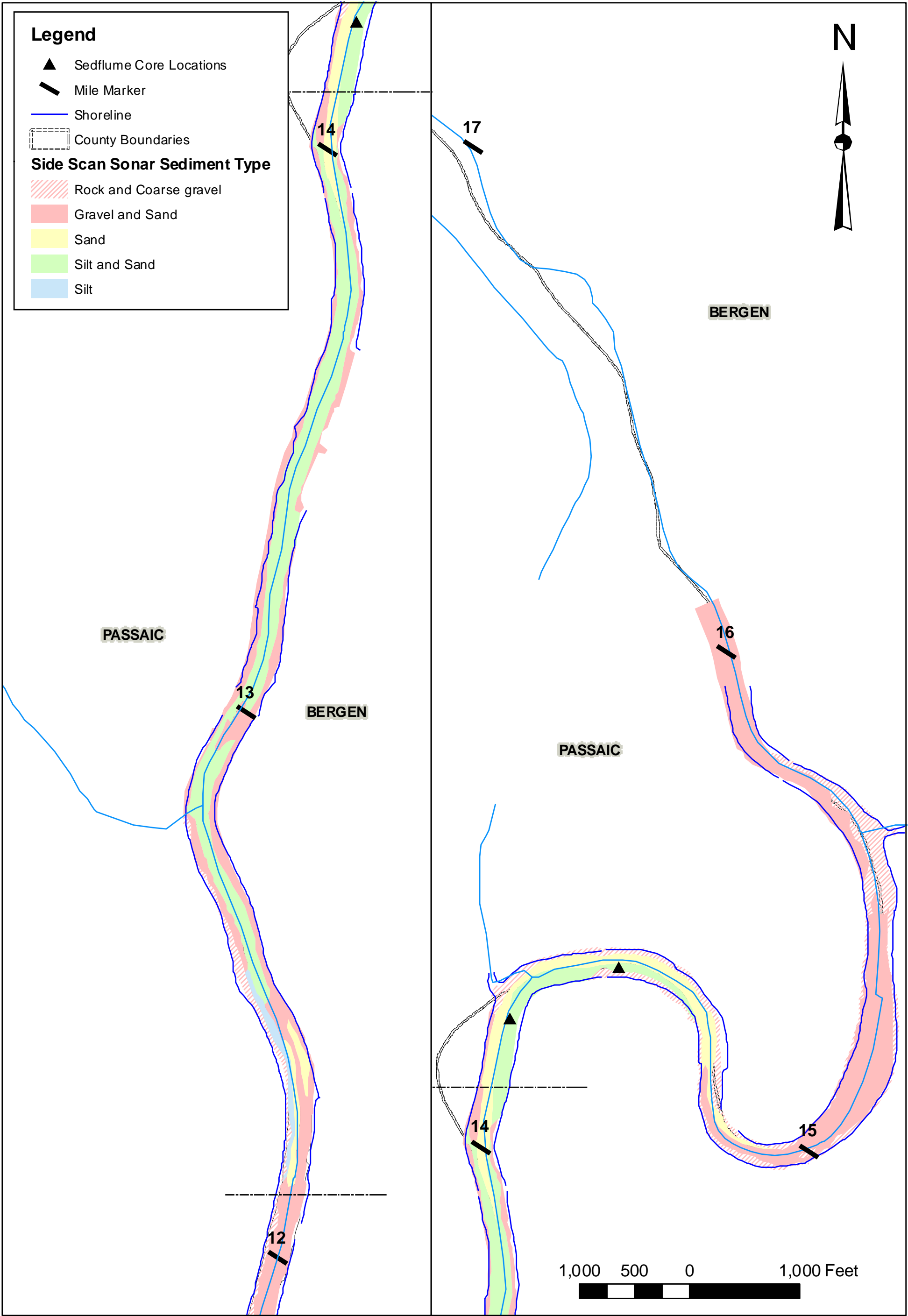
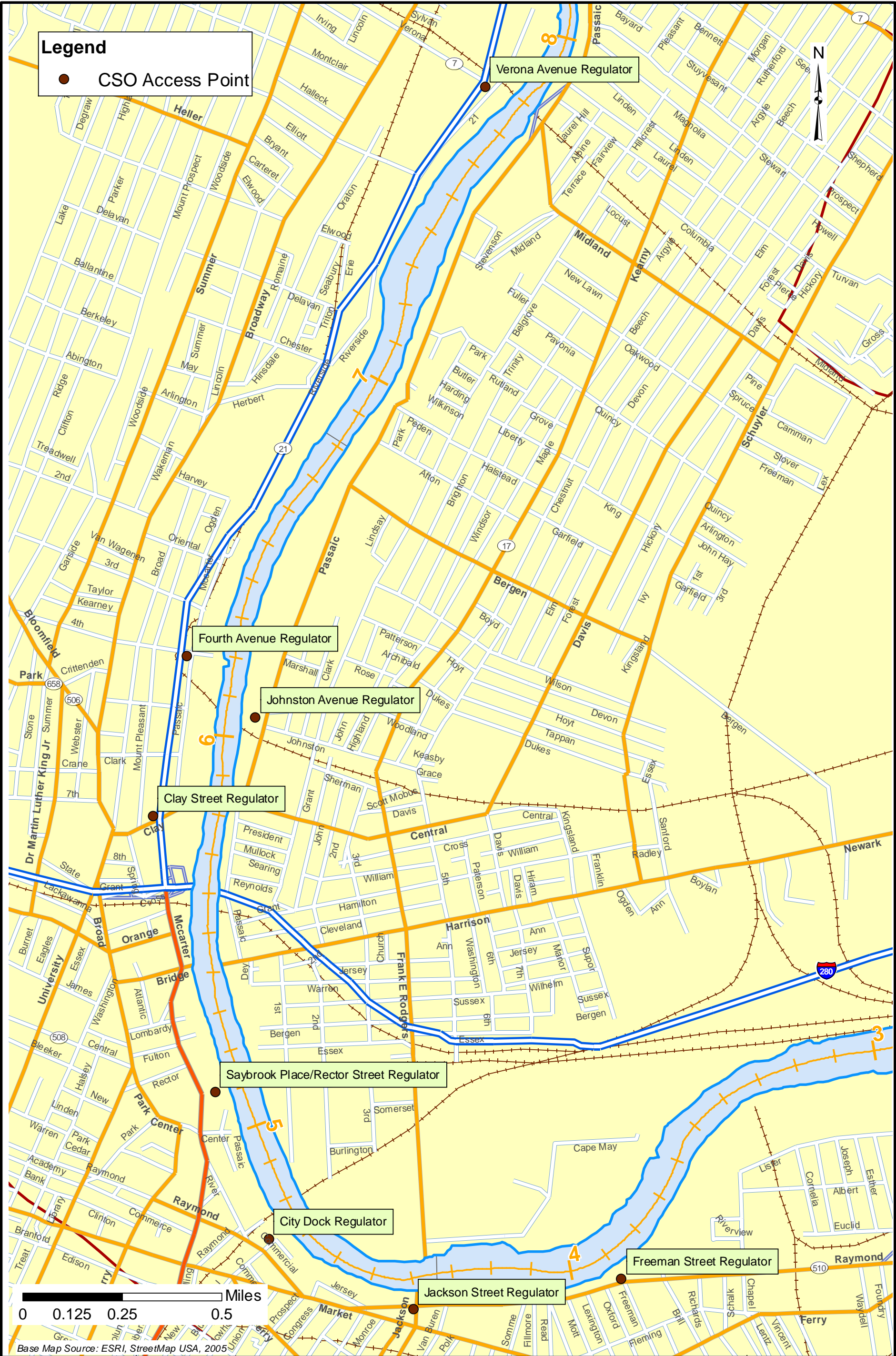


Figure 3-2
Lower Passaic River Restoration Project
Side Scan Sonar Sediment Type Above RM8 to Identify Supplemental Sediment Cores





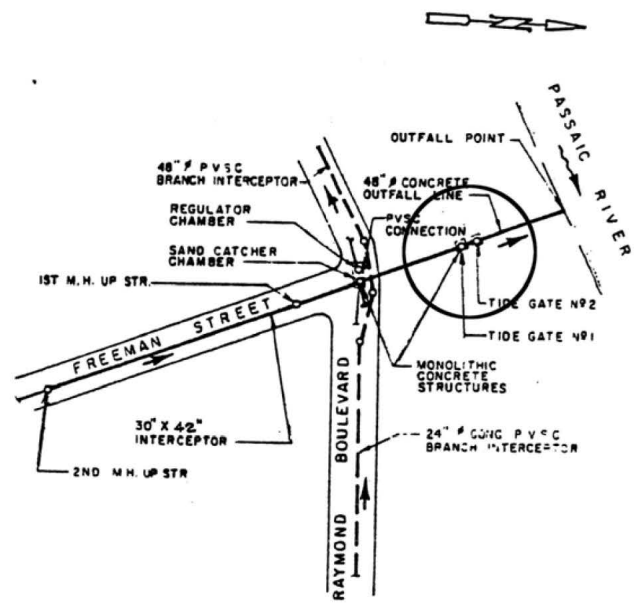
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Map of CSO Access Points
Lower Passaic River Restoration Project

FIGURE 4-1
December 2007

R2-0012076



PLAN



**NUMBER 059
FREEMAN STREET REGULATOR
NEWARK**

**PASSAIC VALLEY
SEWERAGE COMMISSIONERS**

**COMBINED SEWER SYSTEM
FACILITIES INVENTORY AND
ASSESSMENT ANALYSIS**

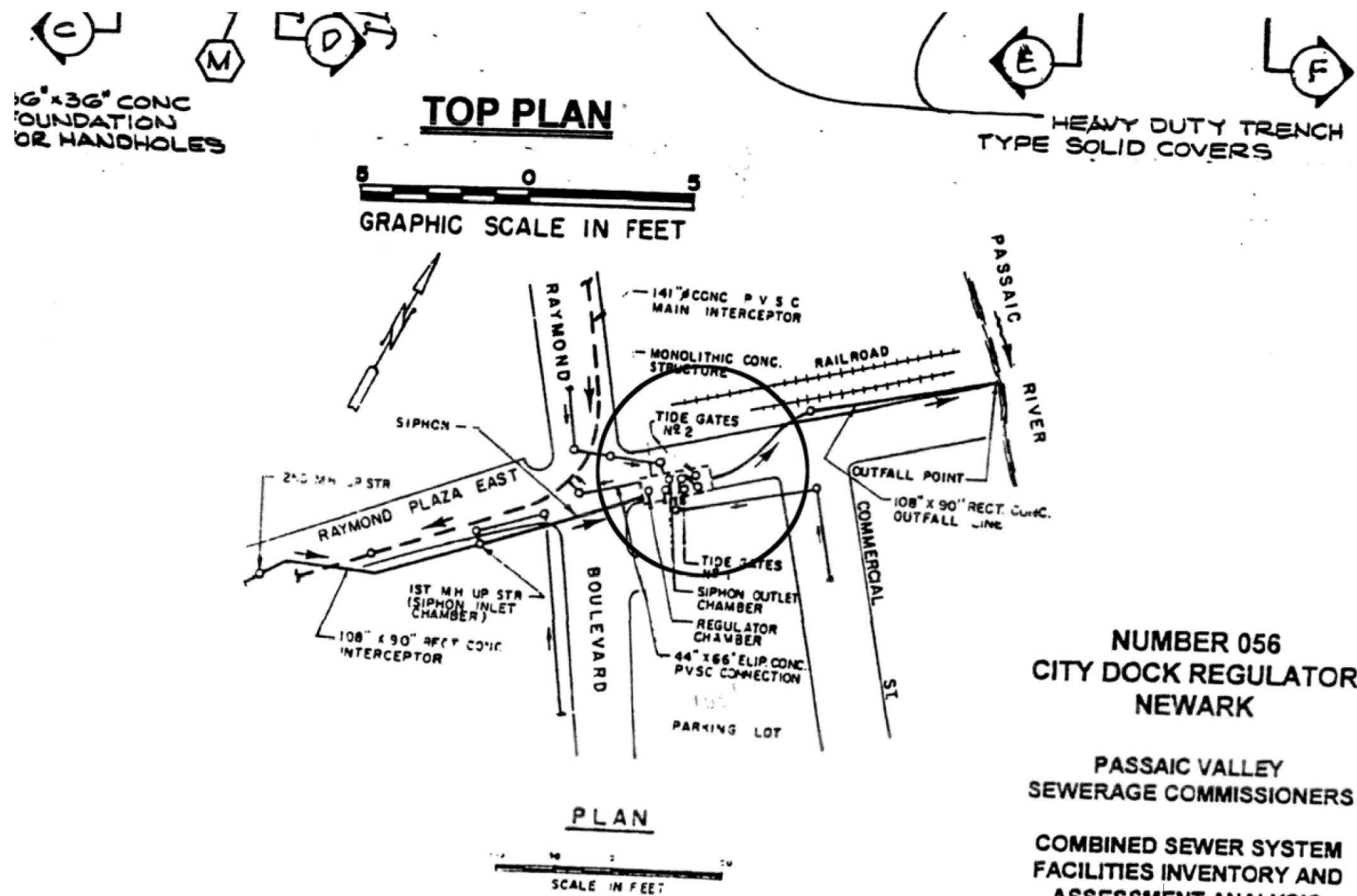


CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

Page 1 of 8



CSOs Sampling Locations

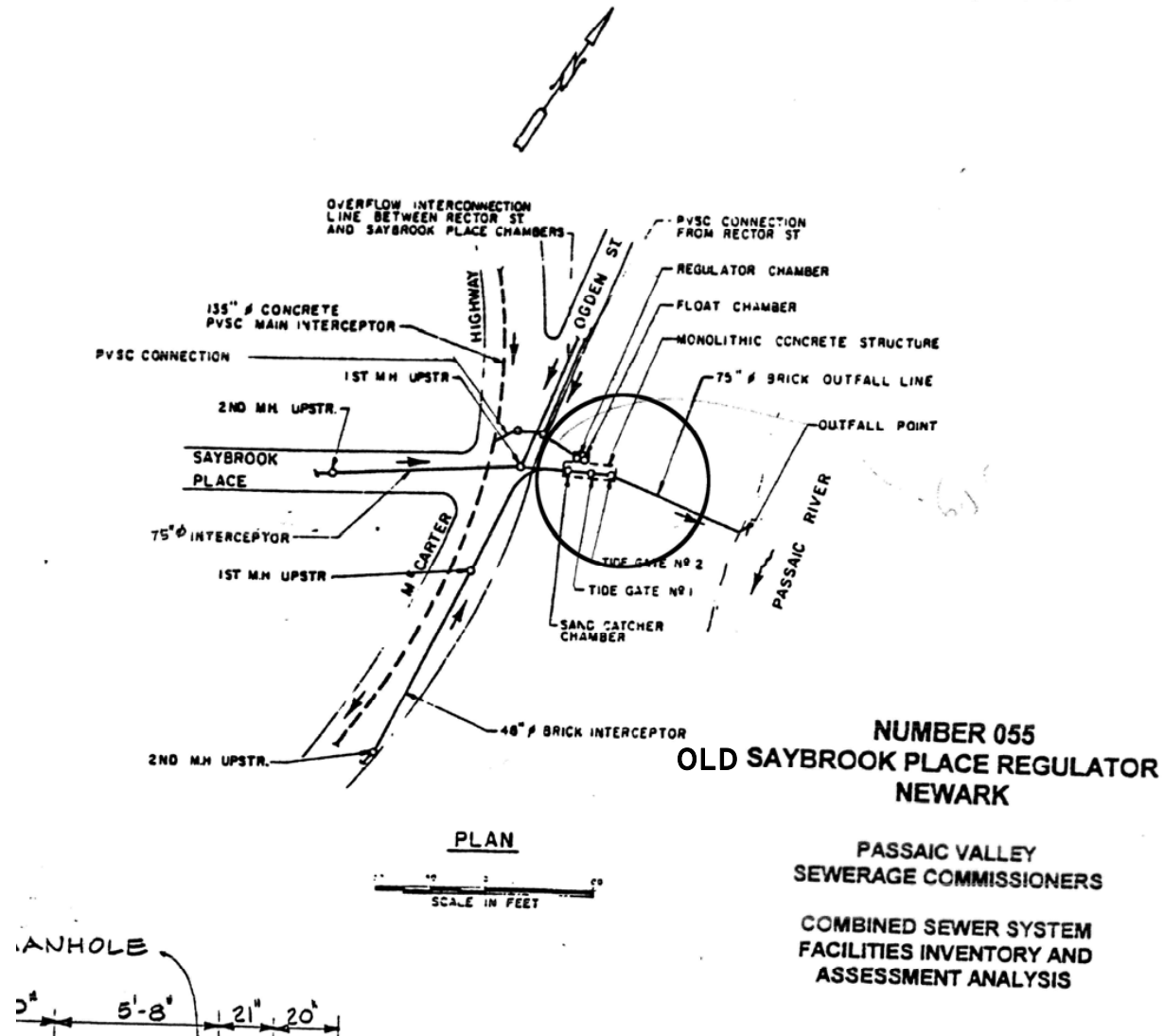
Lower Passaic River Restoration Project

Figure 4-2

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FIGURE 055-1



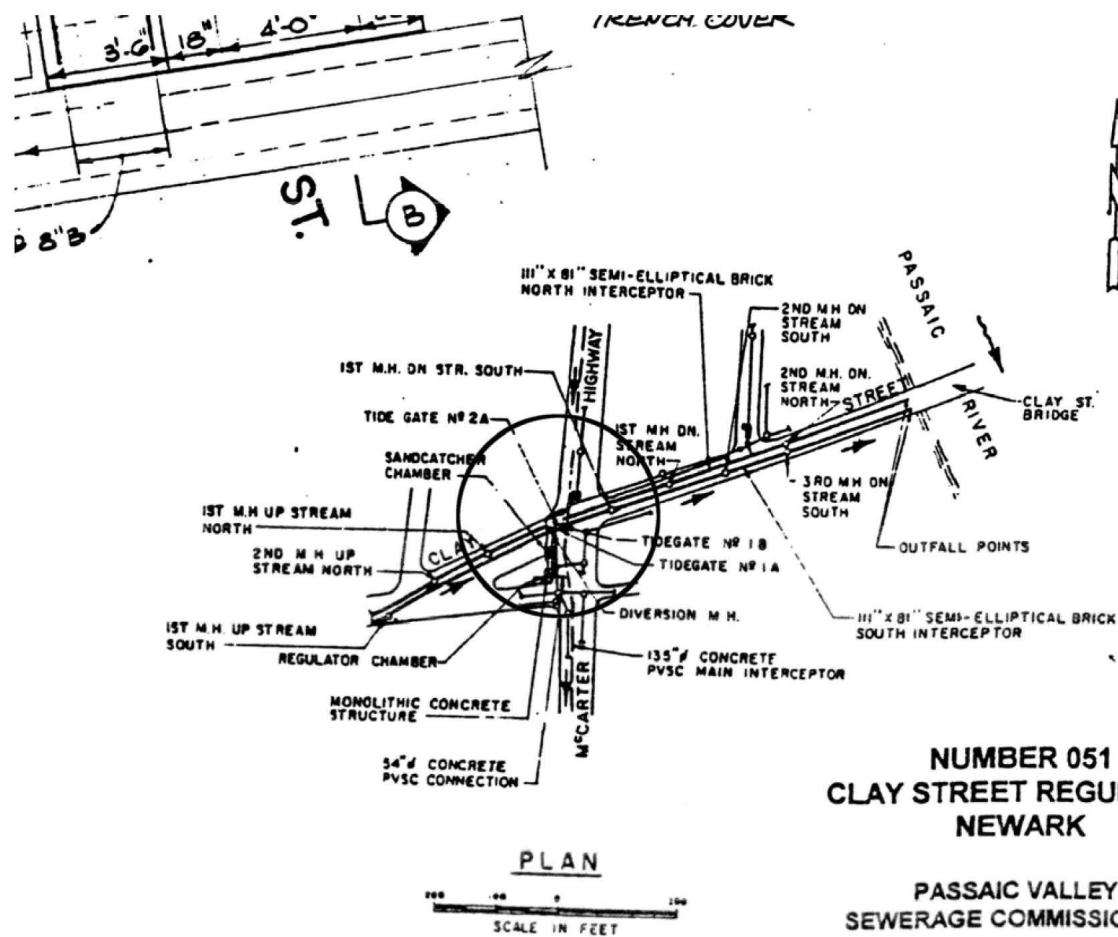
CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

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R2-0012079



**NUMBER 051
CLAY STREET REGULATOR
NEWARK**

**PASSAIC VALLEY
SEWERAGE COMMISSIONERS**

**COMBINED SEWER SYSTEM
FACILITIES INVENTORY AND
ASSESSMENT ANALYSIS**



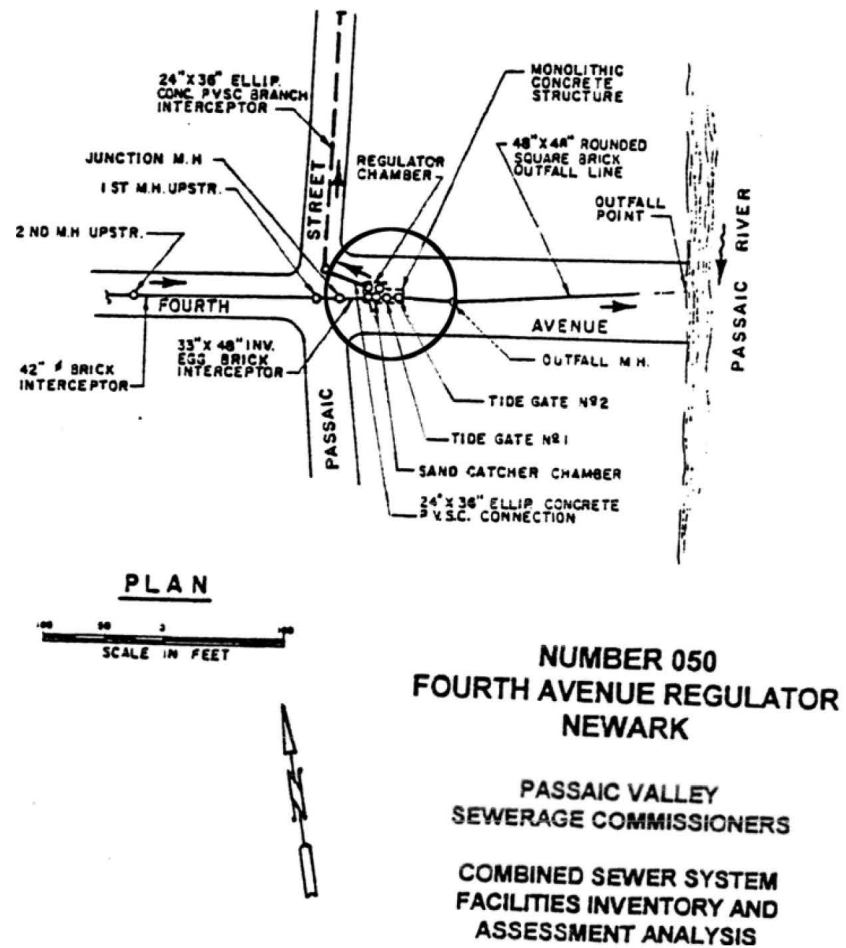
CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

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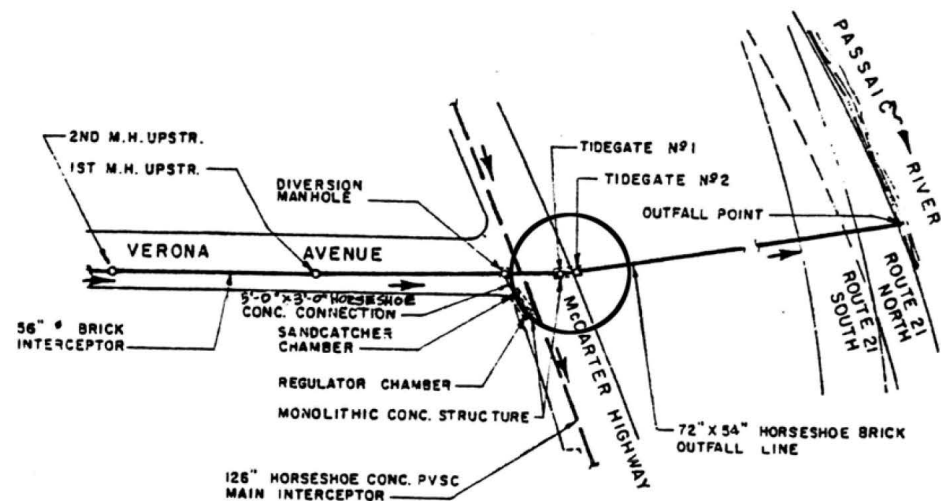
CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

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R2-0012081



**NUMBER 046
VERONA AVENUE REGULATOR
NEWARK**

**PASSAIC VALLEY
SEWERAGE COMMISSIONERS**

**COMBINED SEWER SYSTEM
FACILITIES INVENTORY AND
ASSESSMENT ANALYSIS**



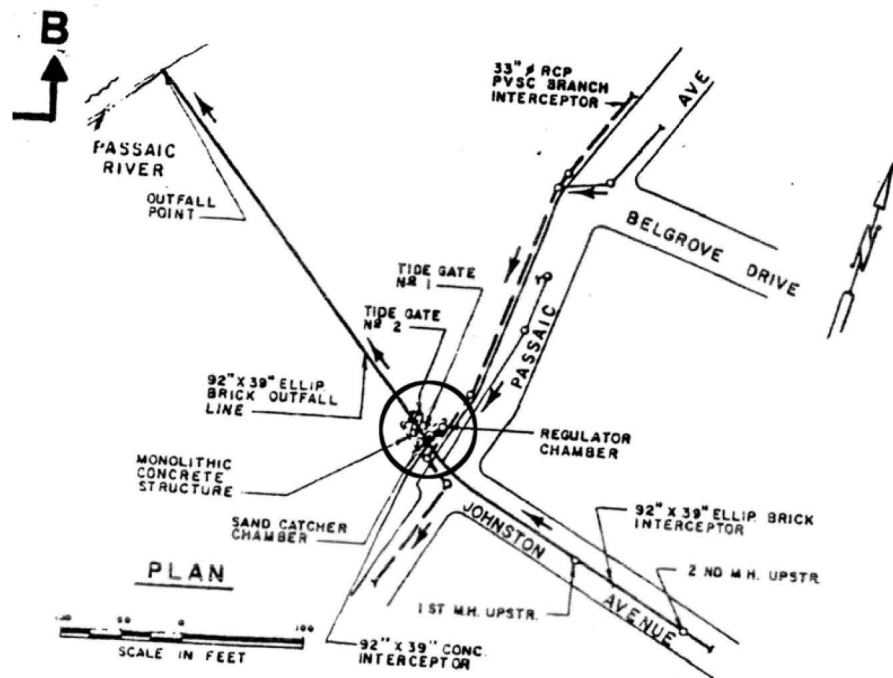
CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

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R2-0012082



**NUMBER 033
JOHNSTON AVENUE REGULATOR
KEARNY**

**PASSAIC VALLEY
SEWERAGE COMMISSIONERS**

**COMBINED SEWER SYSTEM
FACILITIES INVENTORY AND**

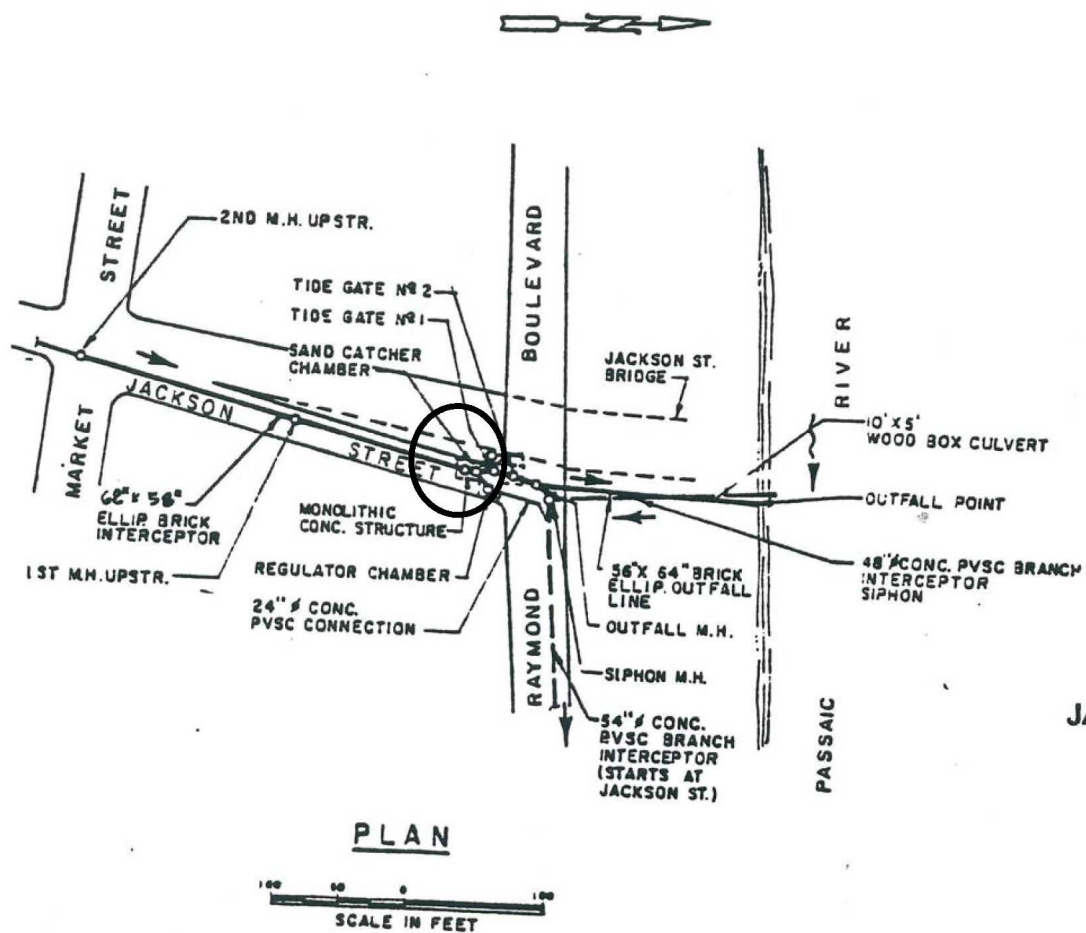


CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

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**NUMBER 057
JACKSON STREET REGULATOR
NEWARK**

**PASSAIC VALLEY
SEWERAGE COMMISSIONERS**

**COMBINED SEWER SYSTEM
FACILITIES INVENTORY AND
ASSESSMENT ANALYSIS**



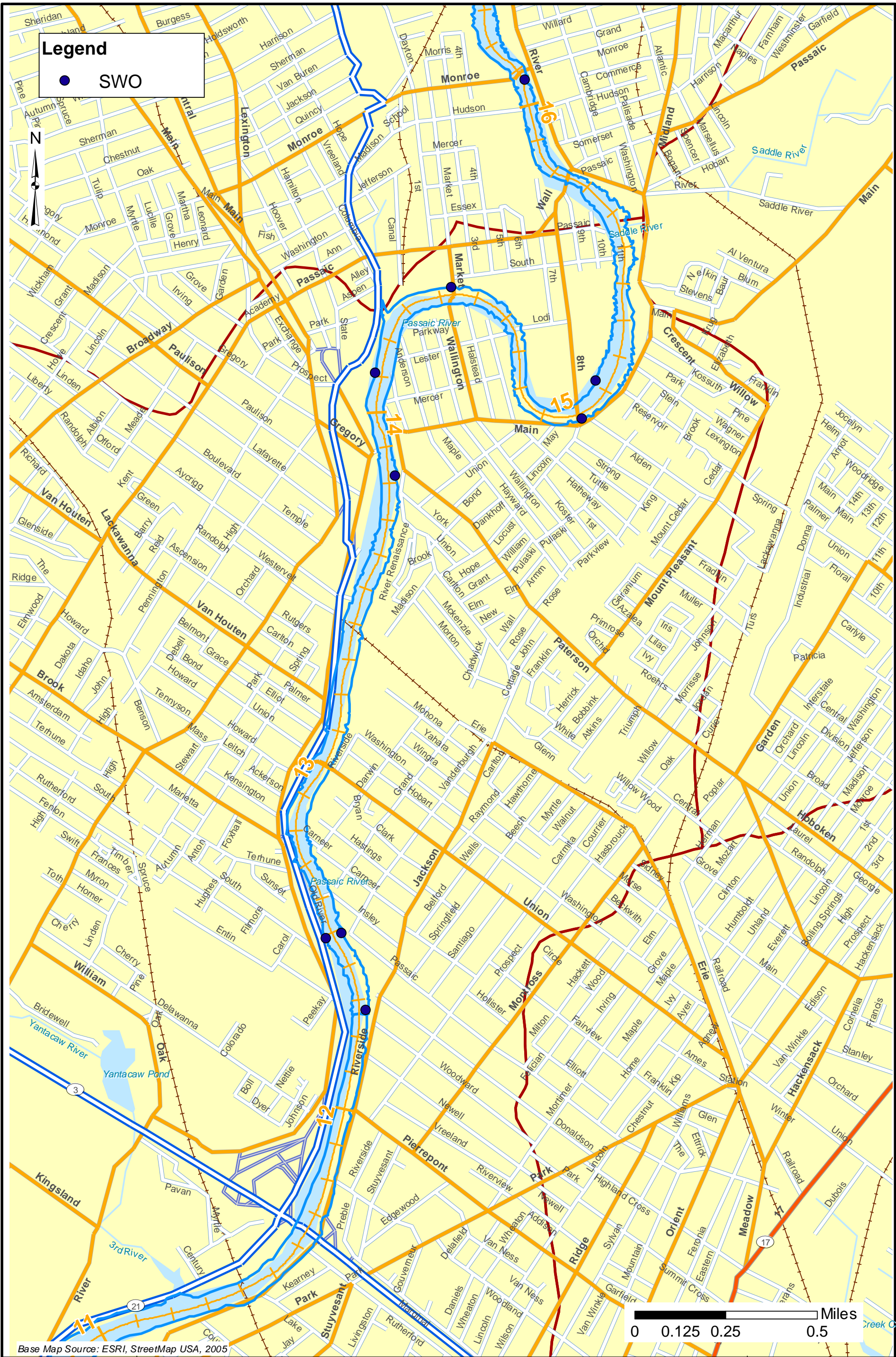
CSOs Sampling Locations

Lower Passaic River Restoration Project

Figure 4-2

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R2-0012084

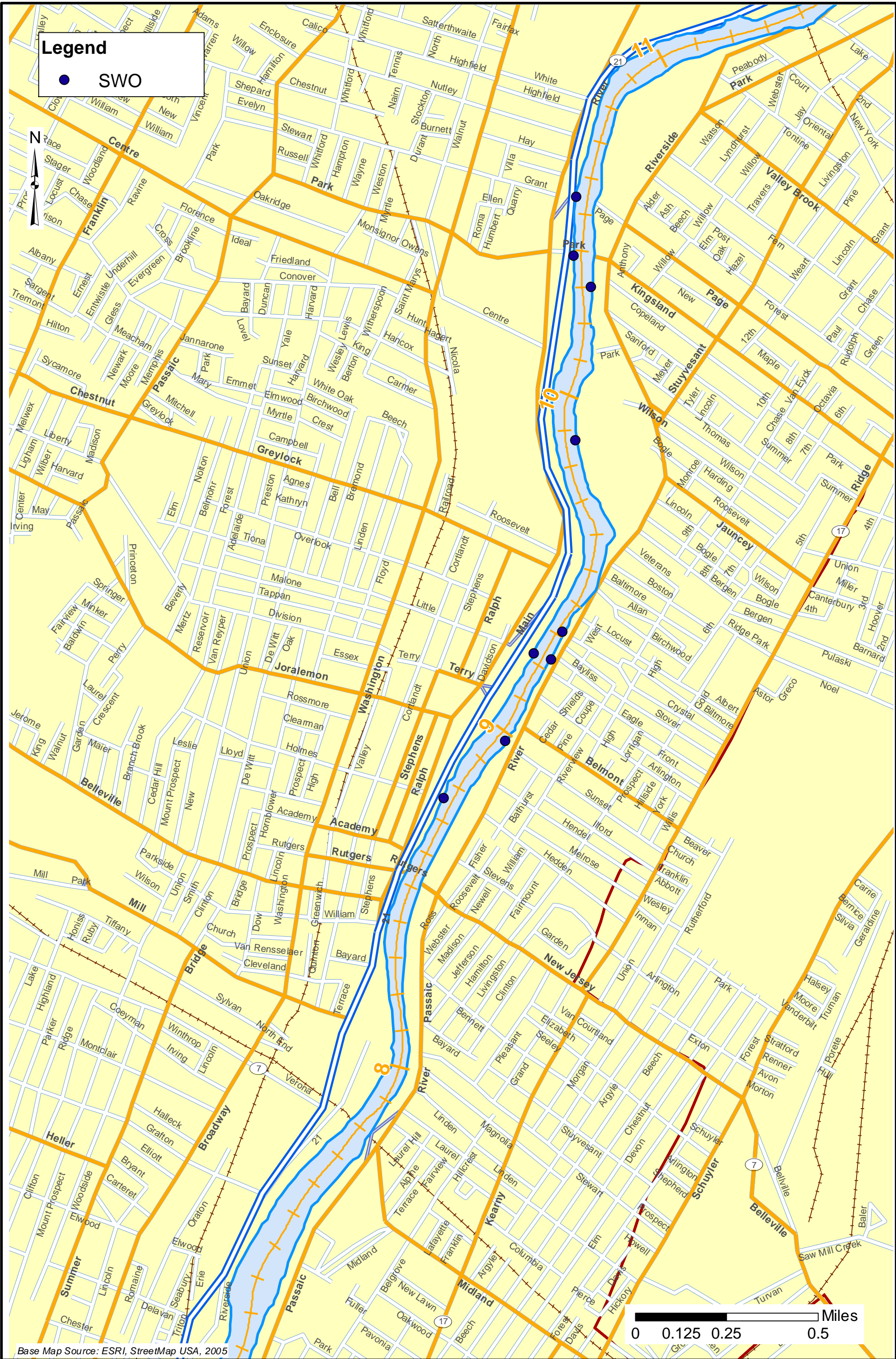


Potential SWO Locations
Lower Passaic River Restoration Project

FIGURE 4-3
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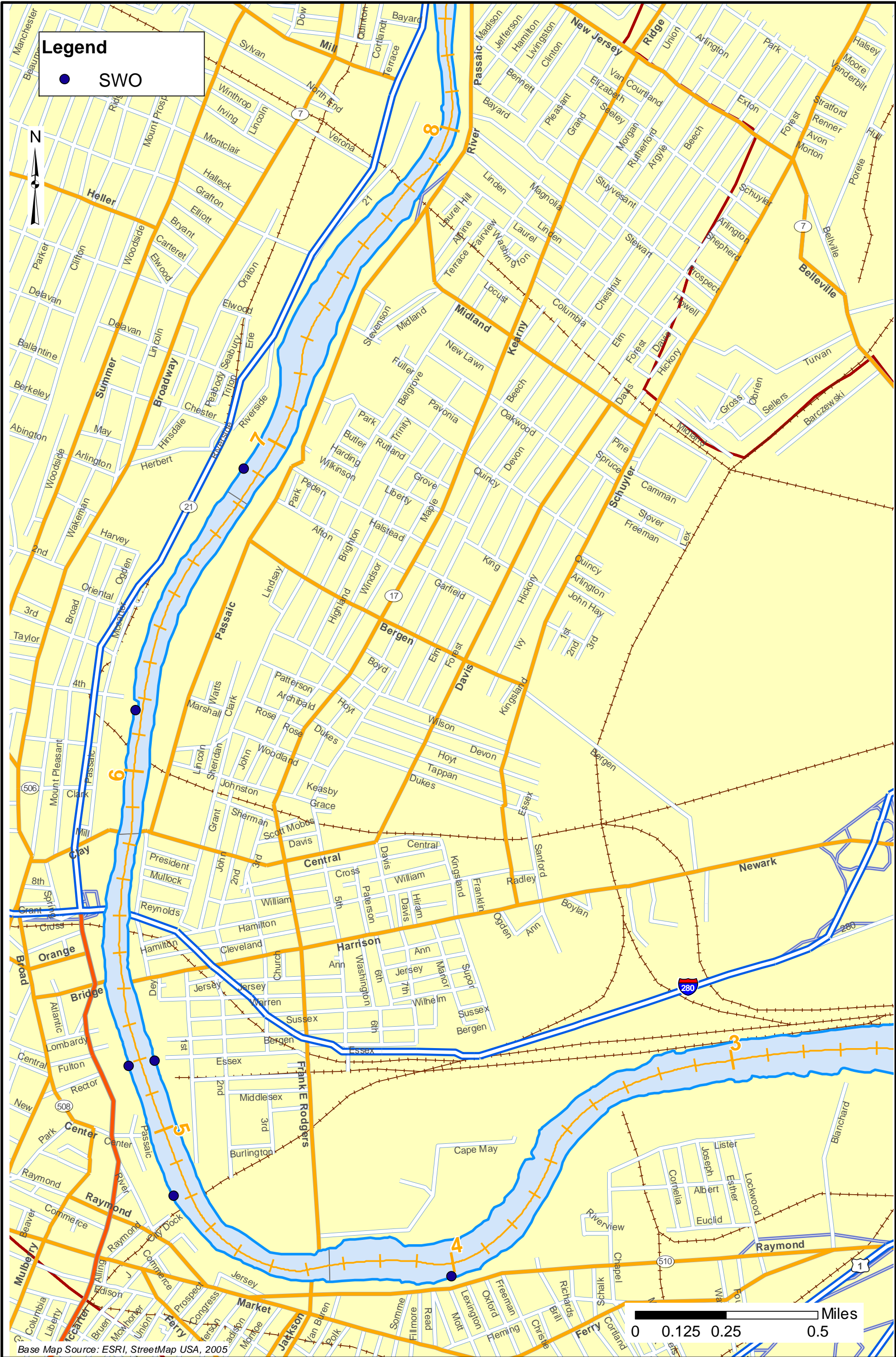
Potential SWO Locations

Lower Passaic River Restoration Project

FIGURE 4-3
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Base Map Source: ESRI, StreetMap USA, 2005



Potential SWO Locations

Lower Passaic River Restoration Project

FIGURE 4-3
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